



Draft Wolf River
Water Resources Management Plan
Shawano Paper Mill Dam
to Keshena Falls

October 14, 2019

Disclaimers

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This document does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Definitions associated with the use of this management Plan.

- Game fish includes all varieties of fish except rough fish and minnows as defined in Wis Stat 29.001(41).
- "Rough fish" includes suckers, not listed as endangered or threatened under s. 29.604 (3), Common Carp, Asian Carp, Goldfish, Freshwater Drum, Burbot, Bowfin, Garfish, Sea Lamprey, Alewife, Gizzard Shad, Rainbow Smelt and Mooneye, per Wis Stat 29.001(74).
- In this document Northern Pike, Walleye, Muskellunge, Largemouth and Smallmouth Bass, Brown Trout, and Brook Trout will be referred to as "predatory game fish". This is to create a collective term to describe this group of species commonly sought by anglers in Wisconsin.
- Panfish includes Yellow Perch, Bluegill, Black Crappie, White Crappie, Pumpkinseed, Green Sunfish, Warmouth and Orange Spotted Sunfish, per NR20.03(29).
- 29.604 (3), Central Mudminnow, Tad "Minnow" includes a sucker not listed as endangered or threatened under s. 29.604 (3), Madtom, Stonecat, Banded Killifish, Blackstripe Topminnow, Brook Silverside, Brook Stickleback, Ninespine Stickleback, Trout-Perch, Darter, Logperch, Sculpin. "Minnow" includes any fish of the cyprinid family that is not listed as endangered or threatened under s. 29.604 (3) and that is not a Goldfish, Grass Carp, Common Carp or Rudd. "Minnow" does not include any sucker, darter, sculpin or minnow species that is designated as detrimental under s. 29.424, per Wis Stat 29.001(54).

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Plan Context

This document serves as the Wisconsin Department of Natural Resources' (Department) comprehensive Water Resources Management Plan for the Wolf River (Plan), from Keshena Falls downstream to the Shawano Paper Mill Dam. This document provides information and management recommendations for use by Department staff regarding fish communities, mussels, aquatic insects, aquatic invasive species, aquatic plant communities, water quality, water levels and flows, and threatened and endangered species. The management recommendations proposed for this section of river take into consideration all facets of the aquatic environment.

The Plan represents the observations and recommendations of the Department. While the Plan may be referenced or utilized by other governmental entities who—within their respective jurisdiction—also conduct regulatory or management activities within portions of the area to which the Plan applies, such reference or use does not necessarily constitute endorsement of the Plan by such entities.

Plan Development and Public Involvement

This Plan will be used by the Department to make decisions and recommendations regarding water resource management for the Wolf River Study Area.

To maximize public input and discussion, the Department, with assistance from the MITW, began the process by hosting three informational meetings. Information presented at these meetings included: sturgeon capture and transfer information, potential fish passage at Balsam Row Dam, the FERC process and information on various license requirements, and the Department's intent to develop this Plan. Listed below are the dates, times, and locations of the informational meetings.

October 17, 2016: Wolf River Management Plan Stakeholder Meeting #1, 6:30 p.m. to 8:30 p.m.
Stone Toad Bar and Grill, 1109 Oneida St., Menasha, Wisconsin 54952

October 18, 2016: Wolf River Management Plan Stakeholder Meeting #2, 6:30 p.m. to 8:30 p.m.
Menominee Indian High School, School Theater, N500 Wisconsin Highway 47, Keshena, Wisconsin 54135

October 19, 2016: Wolf River Management Plan Stakeholder Meeting #3, 6:30 p.m. to 8:30 p.m.
Shawano City Hall, Community Room, 127 S. Sawyer St. Shawano, Wisconsin 54166

A formal public comment period begins on October 21, 2019 and extends through November 20, 2019. A public meeting will be held on November 5th from 6:30-8:30 pm at the Shawano High School in Shawano. During the public comment period, the draft Plan will be available online at <http://dnr.wi.gov/topic/fishing/outreach/WolfRiverManagementPlan>. Hard copies of the Plan will be available at the following locations: Shawano Public Library, WDNR Oshkosh Service Center, and the Menominee-Tribal County Library.

Comments may be submitted during the public meeting, online, or in writing. Written comments should be mailed to David Boyarski, Fishery Team Supervisor, DNR Sturgeon Bay Field Office, 110 S. Neenah, Avenue, Sturgeon Bay, WI 54235, or email address DNRWOLFIVERMANAGEMENTPLAN@wisconsin.gov.

The Department will review and consider all comments received. The final Plan will be presented to the Natural Resources Board.

DRAFT

Executive Summary & Draft Management Recommendations

The Wolf River Water Resources Management Plan (Plan) serves as the Department's comprehensive management plan for the Wolf River, from Keshena Falls downstream to the Shawano Paper Mill Dam. This Plan focuses on fish communities, mussels, aquatic insects, aquatic invasive species, native aquatic plant communities, and water quality. This plan is based on numerous past surveys and known information about this section of the Wolf River as well as specific surveys conducted during the development of this Plan to further our knowledge of the area and specifically guide our management. Department staff consulted with the Menominee Indian Tribe of Wisconsin (MITW), US Fish and Wildlife Service (USFWS), and US Bureau of Indian Affairs (BIA) in the development of this Plan.

The section of the Wolf River from Keshena Falls downstream to the Shawano Paper Mill Dam (Study Area) has a long history of use by Native Americans for sustenance and transportation. Early European settlers also used the Study Area and adjacent landscape for these same purposes. With the onset of western expansion and industrialization of the United States, the Study Area was extensively logged, and the river used for transportation of the lumber to downstream mills. This included the construction of several dams and resulted in wide spread impacts to the landscape and watershed with little regard for conservation and watershed impacts. A notable exception to this large-scale landscape alteration can be found within the MITW reservation. When it was created in 1854, the reservation was densely forested and in 1871 the MITW requested and received permission to cut and sell timber according to their own practices which resulted in a much more conservation-oriented approach on reservation lands. The Study Area for this Plan includes a stretch of the Wolf River, approximately 4 miles in length, which flows through the MITW Reservation. Current land use within the watershed is a mixture of forest land, agriculture and rural residential properties.

In 1892, the Shawano Paper Mill hydropower dam was built on the Wolf River downstream of the reservation which prevented Lake Sturgeon and other aquatic organisms from migrating upstream of that point. Subsequently, the Balsam Row Dam was constructed upstream between Keshena Falls and the Shawano Paper Mill Dam in 1926. Lake Sturgeon could no longer reach their historical spawning grounds at Keshena Falls and throughout the 20th century few if any Lake Sturgeon were seen in the Wolf River within the Study Area.

The river and associated wetlands and upland areas provide habitat and contain populations of a wide variety of fish and wildlife species. The Study Area also supports many human uses besides hydropower generation including fishing, hunting, hiking, camping, gathering, swimming, boating, tubing, and even some waterskiing. Subsistence harvest of game fish with the exception of Lake Sturgeon by MITW tribal members also occurs on those portions of the Study Area that are within the reservation boundaries.

The status of the water resources of the Study Area are inextricably tied to the history and current uses of the river and its watershed. In general, the Study Area has good water quality and habitat that support fish, wildlife and human uses. The management recommendations include measures to continue to conserve these features as well as other recommendations meant to improve the water quality and habitat conditions. Many fish and wildlife populations are strong while some are found in low abundance. For example, many sport fish populations are at or above average statewide metrics while Lake Sturgeon populations and mussel

populations are low. The management recommendations for these features include continuing conservation activities such as the Department and MITW sturgeon transfer project aimed at restoring sturgeon spawning and presence in the Study Area. The management recommendations also include initiating new measures such as establishing baseline objectives for mussel management and exploring options to restore native mussels.

Healthy aquatic plant communities are found within the Study Area including remnant Wild Rice beds. Management recommendations include preserving and protecting these communities. Additionally, Aquatic Invasive Species (AIS) were found in the Study Area. Eurasian Watermilfoil, Rusty Crayfish, Chinese Mystery Snail, Narrowleaf Cattail, Purple Loosestrife, and Aquatic Forget-Me-Not were all found throughout the Study Area. Common Carp and Zebra Mussels have only been observed downstream of the Balsam Row Dam. Management recommendations include continuing monitoring, and measures to reduce risk of additional infestation and movement of AIS upstream of barriers. In addition to these examples, this plan identifies additional management needs and lays out a long list of recommendations meant to continue the existing resource conservation work as well as improve upon the work to recover, restore and protect water resources in the Study Area.

Based on the information gathered during the development of this Plan, the Department has identified the following management objectives.

Water Quality: The Department engages in water quality management planning to protect and enhance water quality as required by the Clean Water Act. To achieve the Department's water quality goals, the following management objectives are proposed.

Objective: Increase efforts to protect stream banks by promoting, maintaining, and increasing native shoreline vegetation. Promote education to landowners of the benefits of shoreline buffers, woody debris, and runoff controls.

- Support, promote and encourage agricultural and urban best management practices to reduce soil loss, turbidity, nutrient loading, etc.

Objective: Incorporate integrated bank stabilization into shoreline protection projects.

- Promote and recommend shoreline stabilization through appropriate methods, including integration of multispecies native plantings and coarse woody structure.

Objective: Continue to monitor water quality using fish and aquatic insect community surveys.

- Continue to assess fish and aquatic insect communities and calculate IBI indices to monitor water quality in the Wolf River and its tributaries using acceptable scientific protocols.

Native Aquatic Plants: Aquatic plants are a critical component of the state's freshwater environment. They help to ensure good water quality and clarity through their influence on sediment stability, nutrient uptake, and oxygen content, while providing habitat and food for fish and wildlife. The Department balances the protection of aquatic plants with the management of invasive and/or nuisance species.

Objective: Maintain, enhance and protect diverse native plant communities.

- Employ appropriate aquatic plant management techniques to eliminate or control Aquatic Invasive Species (AIS).

- Protect and enhance the remnant Wild Rice beds within the river corridor by managing the invasive plants.
- Implement the Department's AIS Early Detection Assessment and Rapid Response Protocols.

Habitat: The Department's Bureau of Fisheries Management Strategic Plan (WDNR 2015c) focuses on an integrative ecosystem approach to protect, restore, and enhance sustainable aquatic habitat and in turn the fish populations they support through habitat enhancement and restoration activities.

Objective: Maintain existing and/or create additional habitat structures for fish cover in the Wolf River.

- Install fish stick projects or tree drop projects in conjunction with shoreline stabilization projects.
- Protect and manage native submerged and emergent aquatic vegetation to balance recreational and habitat needs of the resource.

Objective: Identify and address aquatic organism passage between the Wolf River and its tributaries.

- Explore options to maintain and improve aquatic connectivity, and to provide access to overwintering, foraging, and spawning areas.

Objective: Improve habitat for tributary streams that scored less than "Good" in stream habitat rankings and preserve habitat for tributary streams that scored "Good" or "Excellent".

- Evaluate and implement best management practices to improve and/or preserve tributary stream habitat rankings.

Objective: Maintain appropriate riverine flows to support biologically sound aquatic ecosystems within the Wolf River.

- Work with the hydroelectric dam owners to ensure flow regimes do not adversely impact the aquatic environment and species within it.

Fish: The Department's fisheries management programs are based on scientific management principles which emphasize the protection, perpetuation, development, and use of all desirable aquatic species.

Objective: Manage for diverse and healthy native fish populations by implementing objectives established in the Department's various fish species management plans.

- Continue routine fisheries assessments of the Wolf River.
- Manage panfish populations as directed in the Department's Panfish Plan (2016) and maintain panfish size structure at or above current levels.
- Manage Muskellunge as directed in the Department's Muskellunge Management Plan (1979) and Fisheries Management Handbook to provide a low to moderate density fishery with some opportunity for trophy fish.
- Manage other game fish populations, particularly for Northern Pike, Largemouth Bass and Smallmouth Bass to maintain size structures at or above current levels.
- Manage Lake Sturgeon as directed in Department's Sturgeon Management Plan (being re-drafted at time of publication of this document)

- Implement the non-game fish goals of the Department's 2015-2025 Wisconsin Wildlife Action Plan.

Objective: Implement proper fishery management techniques to control the introduction and spread of aquatic invasive fish species and fish viruses.

- Ensure that management actions include appropriate precautions to prevent the expansion of aquatic invasive species and fish viruses.

Objective: In cooperation with MITW, continue to work toward Lake Sturgeon recovery efforts.

- Continue to update and make revisions to the MITW Lake Sturgeon Management Plan.
- Follow the existing 2011 MOU between the Department and the MITW and begin to develop an updated MOU between the Department and the MITW.
- Continue capture and transfer of Lake Sturgeon to restore Lake Sturgeon to waters above the Balsam Row Dam as needed until recovery efforts are met. Transfer efforts should focus on pre-spawn Lake Sturgeon captured in the spring to facilitate successful spawning and reproduction at Keshena Falls.
- To improve retention of Lake Sturgeon above the Balsam Row Dam and to promote diversity of fish movement strategies, transfer Lake Sturgeon during early fall and late fall time periods.
- Develop and implement assessment protocols for various Lake Sturgeon life stages, including evaluating habitat use and dispersal of naturally produced juvenile Lake Sturgeon in the Wolf River system.
- Establish a communication between the Department and the MITW to share information regarding Lake Sturgeon Recovery Efforts; including acknowledging efforts completed by MITW and the Department.

Mussels: Native mussels play vital roles in aquatic ecosystems, including maintaining water quality and providing cover and colonization habitat. Currently, more than half of Wisconsin's 51 native mussel species are endangered, threatened or listed as species of concern.

Objective: Enhance opportunities for the establishment or expansion of native mussel species in the Wolf River and its tributaries.

- Establish baseline objectives for mussels, including determining habitat availability for mussels and their host species, and considerations for the limits of the mussel or host species range.
- Develop, review and finalize goals and plans for management of Wolf River mussel communities.
- Explore and evaluate freshwater mussel restoration efforts, including through management and promotion of inoculated host fish species or through propagation and release of individual fish or mussel juveniles.
- Monitor mussel populations within the reach of the Wolf River from Shawano Paper Mill Dam to Keshena Falls, following acceptable scientific methodology to assess trends in the mussel community, particularly to evaluate the efficacy of any restoration efforts.
- Develop and implement sampling protocols that target specific habitats for the endangered Salamander Mussel.

- Implement the fresh water mussel goals of the Wisconsin Department of Natural Resources 2015-2025 Wisconsin Wildlife Action Plan.

Aquatic Invasive Species: The Wisconsin Aquatic Invasive Species Management Plan (WDNR 2019) outlines three main goals: prevent the introduction of new AIS into Wisconsin, contain the spread of AIS in Wisconsin, and control existing populations of AIS to minimize harmful impacts. The Department also has an Invasive Species Response Framework to provide guidance to resource managers on the necessary components of an effective response.

Objective: Prevent the introduction and spread of AIS, as well as minimize the ecologic and economic impacts of AIS within invaded systems.

- Conduct periodic early detection AIS monitoring surveys to locate and respond to any new AIS species which are not yet established.
- Utilize the Department's Invasive Species Response Framework to help guide response actions to newly detected populations of AIS.
- Conduct periodic aquatic plant point-intercept surveys to monitor occurrences on non-native submerged aquatic plants such as Eurasian watermilfoil and curly-leaf pondweed.
- Utilize appropriately scaled management techniques to manage AIS species which are shown to be causing ecologic or economic impacts.
- Ensure that actions undertaken, or approvals issued by the Department include appropriate precautions to comply with Ch. NR 40, Wis. Admin. Code.

Tribal Relations: A portion of the Study Area is within the boundaries of the MITW reservation, thus it is critical that the MITW and the Department coordinate and communicate management activities.

Objective: Enhance communication and coordination between MITW and the Department regarding shared resources

- Acknowledge tribal natural resource management and uses of the Wolf River within the MITW Reservation.
- Coordinate resource management strategies where feasible and appropriate.

Introduction to the Wolf River Water Resources Management Plan

This document serves as the Department's comprehensive management plan for the Wolf River, from Keshena Falls downstream to the Shawano Paper Mill Dam. This Plan focuses on fish communities, mussels, aquatic insects, aquatic invasive species, native aquatic plant communities, water quality. Department staff, MITW, FWS, and BIA were involved with the development of this Plan.

The management objectives proposed for the Wolf River Study Area take into consideration all facets of the aquatic environment to arrive at the most appropriate overall management for the greatest good of the river ecosystem and its users.

The Wolf River Study Area

The Wolf River, in Shawano County, is a warm water fishery supporting pan fish and game fish such as northern pike, walleye, largemouth bass, flathead and channel catfish and several threatened and endangered fish species. The river is also significant for the annual spring sturgeon spawning run from Lake Winnebago to the Shawano Paper Mill Dam. All of the creeks and rivers in the western 2/3 of the county which eventually drain into the Wolf River are high quality trout waters and considered exceptional or outstanding waters by the standards in NR 102, Wisconsin Administrative Code (Shawano County Land and Water Conservation Plan).

The Wolf River traverses through northern and eastern Wisconsin. It originates in Forest County, where it flows out of Pine Lake and continues in a generally southern direction through eight counties before emptying into Lake Poygan in Winnebago County. During this journey, it flows through the MITW Reservation. From there it continues through the upper lakes of Poygan and Winneconne on the Winnebago system to its confluence with the Upper Fox River in Lake Butte des Morts. The Wolf River watershed drains 3,690 square miles (Figure 1).

For purpose of this Plan, the Study Area includes a portion of the Wolf River, along with portions of specific tributaries. With respect to the Wolf River, the Study Area extends from Keshena Falls downstream to the Shawano Paper Mill Dam, a reach constituting roughly 13.5 river miles (Figure 2). Approximately four river miles of the Study Area is within the MITW reservation. The Red River, Chickney Creek, Alcohol Creek and Oshkosh Creek are streams that enter the Wolf River within the Study Area, along with several other smaller tributaries.

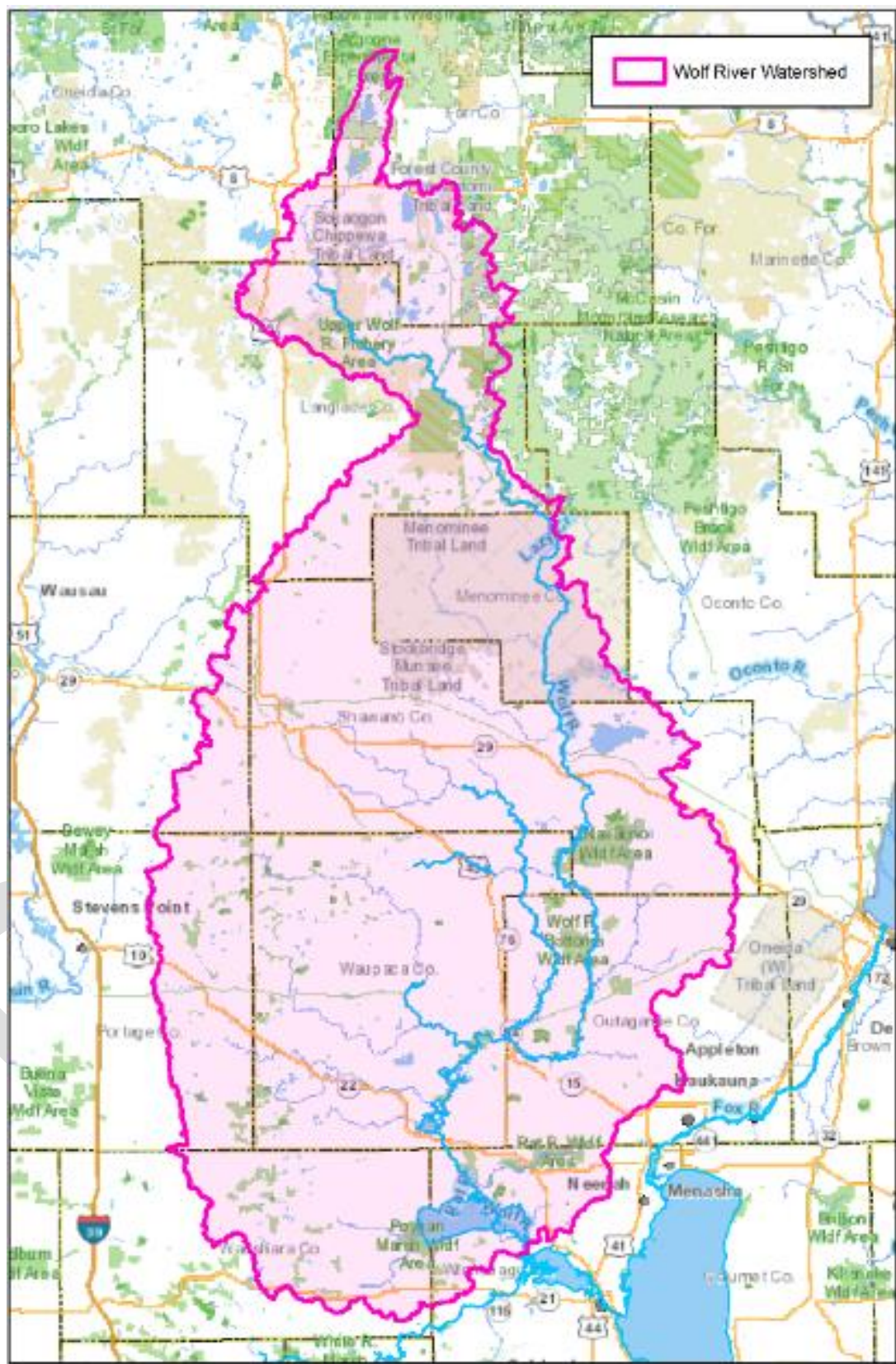


Figure 1. Wolf River Watershed Boundary



Figure 2. The Study Area Comprised of the Wolf River and Associated Tributaries.

History of the Study Area

The history of the Wolf River and the surrounding landscape is intricately tied to the water. Native Americans used the land and the river for sustenance and transportation, as did the early European settlers in the region. As the westward expansion moved into the great prairies west of the Mississippi, a huge demand for lumber arose as towns began to develop. By 1840, the stage was set for the explosion of a lumber industry in the upper mid-west (Fries 1951).

Lumbermen used the Wolf River for transportation of the logs to the mills. Numerous dams were built along the Wolf River to store water and in spring flush the logs downstream to the next holding pond, repeating the process as the logs moved downstream (Monte 2002). This torrential flushing/filling, combined with the erosive force of hundreds of millions of board-feet of timber tumbling downstream, drastically changed the Wolf River, gouging out the substrate and eroding the banks. During the lumber era, the landscape was subject to periodic fires burning through the slash and erosion as rain washed unprotected soils into the rivers, causing siltation and turbidity. By 1900, the lumber era had almost completely dwindled (Fries 1951). What was left behind was a river and landscape forever changed (Monte 2002).

A notable exception to this large-scale landscape alteration can be found within the MITW reservation. When it was created in 1854, the reservation was densely forested. (Loew 2001). Following multiple threats to access and sell timber within the reservation, the MITW in 1871 requested and received permission to cut and sell timber according to their own practices. (Loew 2001). Today, the forest is 230,713 acres, representing the largest single tract of virgin timberland in Wisconsin (WDOA 2019).



Figure 3 Historical Photo of Keshena Falls Pre-Dam Failure



Figure 4 Historic Photo of Keshena Falls Post Dam Failure, circa 1972

The lumbermen who used the Wolf River for transportation of the logs to the mills modified lakes and streams for their need. Numerous dams were built along the Wolf River to store water and in spring flush the logs downstream to the next holding pond, repeating the process as the logs moved downstream (Monte 2002). A dam was built at Keshena Falls in the 1870's for this purpose. Rebuilt several times, the dam ultimately failed in a flood in 1972 and was not reconstructed (Figure 3 & 4).

By the late 1800s agriculture became established in the region. Cheese factories and creameries, and dairy farming became important industries (Shawano County 2016).

Historically, there was a presence of rapids or falls at the Menominee-Shawano County line with a 10-12 foot drop over 400 feet of channel length. Evidence of the rapids disappeared after that part of the river was covered with impounded water and sediment from the construction of hydroelectric dams. Overtime, the river channel between Keshena and Balsam Row Dam has narrowed and incised; this narrowing was likely related to human alterations associated with logging, log drives, or scour related to the Keshena Falls Dam (Fitzpatrick 2005).

Historic properties and other cultural resources are often prevalent along waterways that were at one time heavily used for timber harvest, transportation, and civilization. Early on, several smaller communities and cities developed along the Wolf River. The development was likely a result of the logging industry's use of the river to transport logs to sawmills in Oshkosh (McDonough 2001). Today, urban development is limited primarily to the Keshena and Shawano areas. Current primary land uses in the basin are dairy, cash-crops, and forestry.

Characteristics of the Study Area

Lands within the Study Area can be categorized as upland forest, palustrine wetlands (both forested and emergent), and lacustrine littoral and limnetic aquatic bed. Dominant tree species include White Pine, Northern Red Oak, White Oak, Red Maple, Sugar Maple, White Birch, and Black Ash. Wild Rice and

the invasive Purple Loosestrife are dominant in wetland areas. In general, most of the land in the Study Area is undeveloped forest land, with some agriculture and rural residential properties.

An important element of the Wolf River for the wildlife resource is its north-south orientation on the landscape. This facilitates the migration of species, especially neo-tropical migrating birds and bats. As water warms earlier than the land and insects hatch, these rivers provide abundant food at a critical time in the life cycle of these species. Waterfowl, both dabbling and diving, and wading birds also depend on the river for food and shelter. High banks with exposed soil can provide Bank Swallow and Kingfisher nesting sites. For terrestrial mammals like Black Bear, Fisher, and Bobcats, the forested riparian habitat provides cover for dispersal as weather changes occur, linking the northern forests with the south. The aquatic resources are important to reptiles, amphibians, and furbearers. The wetland plants add biological diversity and provide nesting, egg laying, feeding, resting and brood-rearing sites for many species of wildlife. Exposed shorelines with full sun can provide turtle nesting sites. Coarse woody debris provides basking and resting habitat for turtles and birds and provides cover and habitat for fish and other aquatic species.

Wildlife species occurring in the Study Area include resident and migratory waterfowl, such as Wood Duck, Mallard, Merganser, and Blue-Winged Teal; Eastern Painted Turtle, Snapping Turtle, Wood Turtle, Musk Turtle, and Garter Snake, Mudpuppy, American Tree Frog, Green Frog, and Leopard Frog. Common wildlife includes White Tail Deer, Fox, Beaver, Muskrat, Squirrels, Chipmunks, Rabbits, Wild Turkey, Eagles, and Osprey.

This area has riparian forested habitat with super-canopy White Pines, which provide nesting sites for raptors, specifically Eagles.

Tribal Interests and Considerations

The Study Area for this Plan includes a stretch of the Wolf River, approximately 4 miles in length, that flows through the MITW Reservation. The MITW is a federally-recognized Indian tribe (<https://www.govinfo.gov/content/pkg/FR-2019-02-01/pdf/2019-00897.pdf>), which by virtue of its sovereign status prior to the European exploration and settlement of North America, possesses inherent powers of self-governance except as preempted or extinguished by federal law (Smith 2019). Within these powers is the ability to regulate the conduct of its members, including the manner in which fish, game and other natural resources may be harvested. The MITW is the only federally-recognized tribe within Wisconsin which possesses usufructuary rights within the Study Area.

The MITW's oral tradition indicates that the Menominee originated at the mouth of Wisconsin's Menominee River, just 60 miles from their present-day reservation (Loew 2003) and have continuously resided in Wisconsin since that time.

The Menominee once occupied a vast territory of approximately 10 million acres which included the Study Area (MITW 2019). Through a series of treaties, the majority of these lands were ceded. The present-day MITW reservation was created in 1854 (Treaty with the Menominee 1854). With the exception of the area known as Middle Village, the boundaries of the reservation are identical to the boundaries of Menominee County (WDOA 2019). The reservation is 235,524 acres and contains

approximately 223,500 acres of heavily forested lands, representing the largest single tract of virgin timberland in Wisconsin. Approximately 98 percent of the reservation's acreage is held in trust status, with the remaining two percent owned in fee simple. (WDOA 2019)

Historically, the Menominee pursued a nomadic life of hunting, fishing, gathering and agriculture. The lakes, rivers, and adjacent marshes supplied fish, waterfowl, other wildlife species and Wild Rice. These natural resources were integral to Menominee's spiritual, social, political and economic identity. Within the Study Area, two resources were especially significant: Wild Rice and Lake Sturgeon (Beck 2002).

The importance of Wild Rice to the Menominee is evidenced in their own name: "Menominee" is derived from the Algonkian word "manomin", which means "wild rice" (Beck 2002). They were known by neighboring tribes as the "wild rice people" and French explorers called the Menominee "Folles Avoines", the French term for Wild Rice. Tribal oral tradition indicates that the Menominee's relationship with Wild Rice began at the time of their creation. Numerous accounts from European explorers and missionaries described the presences of wild rice beds throughout the Menominee's territory, as well as harvest techniques as practiced by the Menominee. (Beck 2002).

Tribal oral tradition reveals that the Menominee's relationship with Lake Sturgeon is also linked to their creation, when it provided the first food (Medin et al. 2006). Lake Sturgeon became an integral part of the Tribe's spiritual life and identity. Lake Sturgeon not only provided food after the end of long winters but was used to make tools and medicines (Beck 2002). Each spring the Menominee would celebrate the return of Wolf River Lake Sturgeon to spawning grounds near Keshena Falls by holding a special ceremony to mark the beginning of new life. In the early 1850s, Lake Sturgeon played a significant role in the selection by tribal leaders of the site for the MITW's reservation. (Beck 1995).

The building of the Shawano Paper Mill hydropower dam on the Wolf River downstream of the reservation in 1892 prevented the Lake Sturgeon from reaching Keshena Falls and throughout the 20th century few if any Lake Sturgeon were seen in the Wolf River within the Menominee Reservation. By the 1950s, Lake Sturgeon had been extirpated from the reservation.

In the early 1990's the MITW, in coordination with the Department and the USFWS, developed and implemented the Menominee Reservation Lake Sturgeon Management Plan (Appendix D). Recognizing the importance of Lake Sturgeon to the Menominee culture and to help achieve restoration goals, the Department and the MITW entered into a Memorandum of Understanding (MOU) in 2011 to manually transfer Lake Sturgeon from waters below the Shawano Paper Mill Dam up to Keshena Falls. These efforts have allowed for limited successful spawning and a minimal number of resident Lake Sturgeon above the Balsam Row Dam. With respect to the significance of Lake Sturgeon as described in the FERC record, the MITW support the installation of upstream and downstream fish passage at the Balsam Row Dam to work towards their goal of restoring connectivity within the Wolf River.

Today, the MITW regulates and manages on-reservation resources within the Study Area in a variety of ways. The MITW's Conservation Commission, with the approval of the Tribal Legislature, establishes hunting, fishing and trapping regulations applicable to members harvesting within the reservation boundaries. (Menominee Code § 287-1, 287-3). These regulations establish harvest parameters for an array of fish and game species that are present within the portion of the Study Area within the

reservation boundaries. The Department of Environmental Services undertakes a variety of management, restoration and monitoring activities with respect to natural and environmental resources within the reservation (MITW 2019b). The MITW has also developed strategic and management plans applicable to on-reservation resources within the Study Area. These plans identify the MITW's goals and objectives specific to management needs of the resources.

Other Resource Uses

Tourism and outdoor recreation started to develop around the turn of the century. River uses, and opportunities are different in various sections of the Study Area due to depth of water and public access. The extensive forest areas provide opportunities for hiking, camping, gathering, and hunting. The Wolf River and its tributaries provide opportunities for fishing, gathering, swimming, boating, tubing, and even some waterskiing. The deeper waters of the river are more conducive for motorboat activity. Subsistence harvest with the exception of Lake Sturgeon by MITW tribal members also occurs on those portions of the Study Area that are within the reservation boundaries.

Hydroelectric Generating Stations

There are two hydroelectric dams within the Study Area. These dams are licensed by the FERC. Additionally, the Department works with the licensees regarding license compliance, and dam repairs.

Shawano Paper Mill Hydroelectric Dam

The Shawano Paper Mill Dam was built in 1892 and began hydroelectric operation in 1913 (Figure 5). In 1985, the dam was issued a specific type of FERC license commonly referred to as an "Exemption". The Shawano Paper Mill Dam (P-8015) is locally known as Shawano Dam or Little Rapids and is an active paper mill and hydroelectric dam which develops, manufactures and markets specialty papers. The Shawano Paper Mill Dam is located downstream of the Balsam Row hydroelectric dam and is the first barrier on the Wolf River upstream from Lake Poygan on the Winnebago System.

The FERC project boundary for the Shawano Paper Mill Dam extends from the upstream side of the dam, to the northern extent of the Wolf River Pond at Elm Avenue, and also extends up into the Shawano Lake Outlet Channel as far as North Main Street (Figure 7).



Figure 5 Shawano Paper Mill Dam on the Wolf River

Balsam Row Hydroelectric Dam

The Balsam Row Dam was constructed in 1926 (Figure 6). The original hydropower license (P-710) for Balsam Row Dam was issued by FERC in 1927. The current license was issued by FERC in 1997 (see Appendix A).

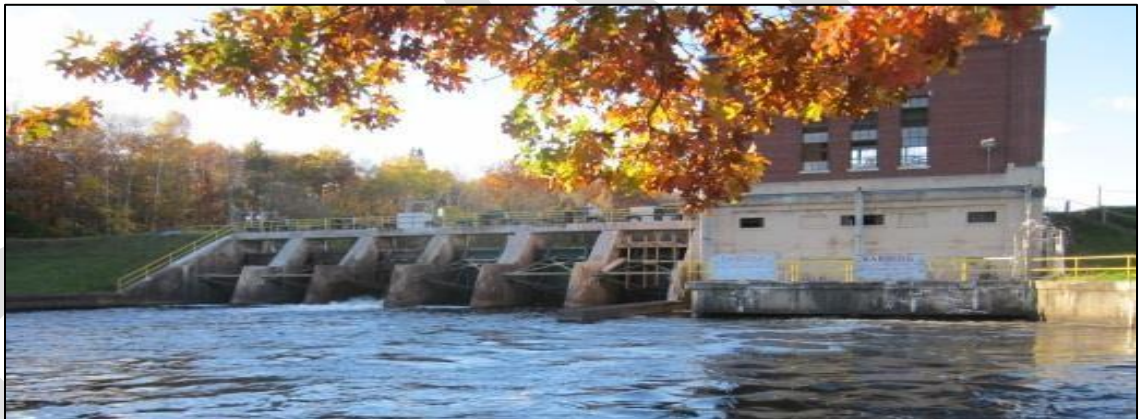


Figure 6 Balsam Row Dam on Wolf River, Shawano County

FERC issued a license in 1997. In 2006, FERC amended certain articles of the license. These amendments occurred following a request from the Licensee, MITW and DOI which stemmed from a 2006 Settlement Agreement between the same three parties.

The Balsam Row Dam FERC project boundary extends from upstream of the Balsam Row Dam to Fairgrounds Road in Keshena and follows the Wolf River (Figure 7). The Study Area for this Plan includes the Balsam Row FERC project boundary and an additional 2 miles of river from Fairgrounds Road to Keshena Falls; and from the Balsam Row Dam downstream to the Shawano Paper Mill Dam.

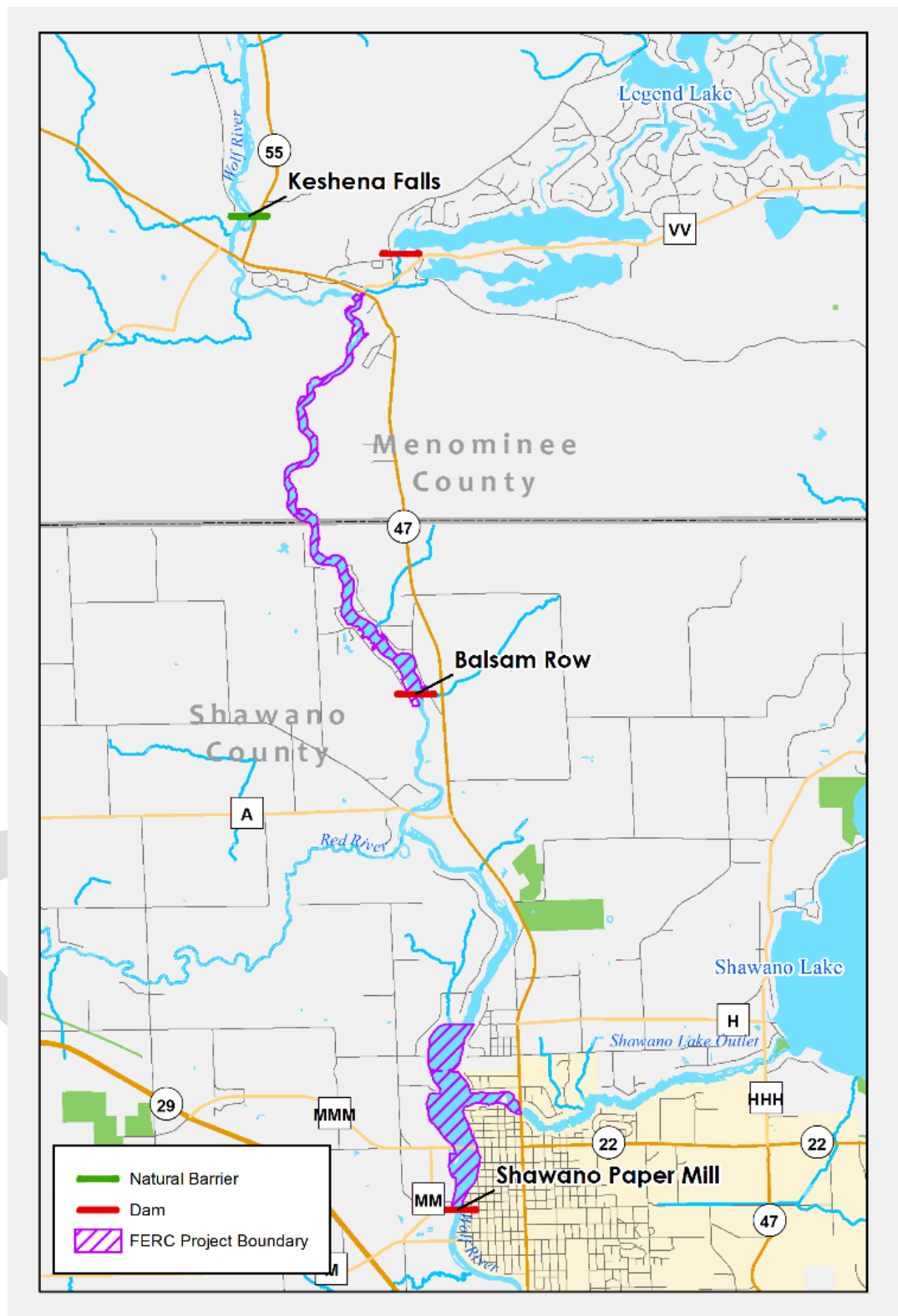


Figure 7 FERC Project Boundary for Balsam Row Dam and Shawano Paper Mill Dam

Water Levels and Flows

Water levels and river flows are maintained by the dam operations, as outlined in their respective FERC licenses. The Shawano Paper Mill Dam is required to maintain a water level at the dam reservoir between 801.83 and 803.17 msl, a range of about 12 inches. The Balsam Row Dam maintains a normal pool level of about 818.0 +or – 0.3 feet National Geodetic Vertical Datum (NGVD) and operates in a run-of-river mode.

Water levels and flow comparisons for the Regional Flood Event or 100-year events are defined within the effective Federal Emergency Management Agency (FEMA) Flood Insurance study dated November 15th, 1985. The Wolf River peak discharges associated with the 10-year, 50-year, and 100-year (Regional Flood) for each dam are listed below.

Table 1 Peak Flow Values for Dams Within the Wolf River Study Area

Shawano Paper Mill Dam Peak Flows (cfs)			Balsam Row Dam Peak Flows (cfs)		
10 year	50 year	100 year	10 year	50 year	100 year
5065	6580	7220	3580	4490	4865
Regional Flood Elevations NGVD			Regional Flood Elevations NGVD		
Upstream = 804.5			Upstream = 820.9		
Downstream = 797.7			Downstream = 810.3		

The United States Geological Survey (USGS) maintains a gage (USGS 04077400) along the Wolf River. The gage is located at Lat 44°50'09", long 88°37'30", in SE 1/4 NW 1/4 sec.12, T.27 N., R.15 E., Shawano County, Hydrologic Unit 04030202, on left bank 350 ft downstream from dam, 3.7 mi north of Shawano, 1.5 mi upstream from Red River, and at mile 130.6. (USGS website)

Daily discharge metrics for this USGS gage station based on June 30th for the period of record are shown in Table 2.

Station 04077400 was operated in cooperation with Alliant Utilities Company and the Wisconsin Department of Natural Resources, through June 30, 2001. Effective July 1, 2001, the station is owned and operated by Wolf River Hydro, and real time data is no longer available on the USGS website.

Table 2 Daily Discharge (cfs) Based on June 30 values at Station on Wolf River (up to 2001)

Min (1988)	25th percentile	Median	Mean	75th percentile	Max (1993)
336	559	657	738	881	1700

Natural Resource Information within the Study Area

Summaries of both historic and recent survey data are presented and summarized in the following sections. Summaries are presented for protected species, aquatic habitat, water quality, aquatic plants, aquatic insects, crustaceans and snails, freshwater mussels, and fisheries populations.

Endangered Resources Summary

The Wisconsin Endangered Species Act, s. 29.604, Wis. Stats., directs the state to establish a list of endangered and threatened species of fish, wildlife and plants within Wisconsin. The state's Endangered Species Law makes it illegal to take, transport, possess, process, or sell any animal or fish that is included on the Wisconsin Endangered and Threatened Species List, unless otherwise authorized by the appropriate Department approval. The Department also designates species of special concern, the purpose of which is to focus attention before they become threatened or endangered (WDNR NHC).

The Federal Endangered Species Act, 16 U.S.C. § 1531 et. seq. (1973), authorizes the FWS to create a list of threatened and endangered species of fish, wildlife and plants within the United States. The Federal Act prohibits any action that causes a taking of any listed species of endangered fish or wildlife. Import, export, interstate, and foreign commerce of listed species are also generally prohibited. The FWS may additionally elect to designate and protect the critical habitat of a listed species. All species which are federally-listed receive the same protections under the Wisconsin Act that apply to state-listed species.

In addition, there may be other state and federal laws protecting rare species including the federal Migratory Bird Treaty Act, the federal Bald and Golden Eagle Protection Act, and the Protected Wild Animals (NR 10.02 WI Admin Code).

Wisconsin DNR's Natural Heritage Inventory program maintains data on the general location and status of threatened or endangered plant and animal species and natural communities and species and communities of special concern.

The review for state and federally listed species was completed by Department staff by using the Department's Natural Heritage Inventory (NHI) Database to look up species occurrence records within the Study Area. The NHI Database contains records for all threatened, endangered, or special concern animals and plants, as well as unique features and high-quality natural communities. Department staff evaluated the occurrences of each species within the Study Area. If a species was not likely to be found in the Study Area due to lack of suitable habitat it was eliminated. Species reported in the Study Area were those known to occur within the Study Area or likely to occur based on their proximity to the Study Area with suitable habitat. Additionally, staff reviewed the Department's existing database of listed species in the adjacent upstream and downstream waters. No records were included below the Shawano Paper Mill Dam because it is outside the scope of the Plan.

The following species have been identified in the NHI Database as being in or near the Study Area. Due to the scarcity of these species, they may be present in the Study Area, but were not observed during the 2014 and 2016 sampling events.

- The River Redhorse (State Threatened) prefers moderate to swift currents in large river systems and prefers river bottoms with clean gravel. They may make upriver spawning migrations and spawn on nests in gravel. The species is quickly restored to waters from which they have been eliminated if there is a reservoir population nearby (Becker, 1983). This species has been collected in the Wolf River below the Shawano Paper Mill Dam, but was not encountered during the 2016 surveys, although other redhorse species were collected. It is possible that this species may occur within the Study Area but is rare enough to have not been encountered.
- The Lake Sturgeon (Special Concern) prefers large rivers and lakes, and prefers to spawn in shallow, rocky areas, with adequate current. It is listed as a Special Concern species due to the length of time required for it to reach sexual maturity and to ensure proper management for its long-term ecological sustainability. Adult Lake Sturgeon have been transported above the Shawano Paper Mill and Balsam Row Dams since 1995. Lake Sturgeon has been observed throughout the Study Area.
- The Wood Turtle (State Threatened) prefers rivers and streams with adjacent riparian wetlands and upland deciduous forests. This species nests in open or semi-open canopy areas containing gravel or sandy soils, typically within 200 feet of the water. The Wood Turtle is widely distributed throughout the Study Area. Adequate nesting sites are known to occur within the Study Area, and nest sites are often a limiting factor for this species.
- The Blanding's Turtle (Special Concern) is found in a wide variety of aquatic habitats including deep and shallow marshes, shallow bays of lakes, rivers and ponds where areas of dense emergent and submergent vegetation exists, and sedge meadows and wet meadows adjacent to these habitats. This species is semi-terrestrial and may spend quite a bit of time on land and move between a variety of wetland habitats. They strongly prefer to nest in sandy soils and may travel far from a wetland or waterbody to find suitable nesting sites. Although this species has been reported in the Study Area, habitat is limited for this species, due to its preference for wetland types not readily available within this reach of the Wolf River.
- The Smoky Ruby Spot (Special Concern) is a damselfly that occurs in rivers of swift current. The flight period occurs in early September. It was not encountered during recent aquatic insect surveys in the Study Area. This species could likely be present but rarely encountered due to its scarcity and would require extensive seasonal surveys to verify its presence. It does not appear to be limited in habitat within the Study Area or restricted in its dispersal.
- The Bald Eagle (Federally Protected) is protected by the Bald & Golden Eagle Protection Act. It prefers large trees in isolated areas in proximity to large areas of surface water, and large

complexes of forest, wetland, and shrub communities. Large lakes and rivers with nearby tall pine trees are preferred for nesting. It is known to occur within the Study Area and is known to nest in proximity to the river. Bald Eagles appear to use the Wolf River corridor without restrictions for feeding, roosting and nesting.

- The Salamander Mussel (State Threatened / Federal Special Concern) is found in mud, silt or sand substrates beneath medium to large-sized flat rocks and undercut ledges, where its sole host, the mudpuppy frequents. It can be very abundant locally, but extremely rare otherwise and is only found in its specialized habitat. Historically the Salamander Mussel has been found in the Study Area but was not observed during recent surveys. The host species for the Salamander Mussel, the Mudpuppy, was captured during current fisheries surveys in both the Wolf River Pond and Balsam Row Pond. This species was not targeted during recent mussel surveys due to special sampling techniques required to survey for them and their specialized habitat under large rock slabs and undercut ledges.
- The Slippershell mussel (State Threatened) is found in small to medium-sized streams with flowing hard water, and sand or gravel bottoms. The known hosts are Banded Darter, Mottled Sculpin, and Johnny Darter. Historically the Slippershell has been reported in low numbers throughout the Study Area and its tributaries. During recent surveys the Slippershell was collected above and below Balsam Row Dam. It is typically found in small to medium size streams and may be at the lower end of its habitat range in the Wolf River. The host fish prefer smaller streams and may be more abundant in tributaries entering the Wolf River.
- The Elktote (State Special Concern) is found in various-sized streams with flowing water, sand, gravel or rock substrates that are stable. Historically the Elktote was common throughout the Study Area, and recent surveys collected it above and below Balsam Row Dam, but in very limited numbers. The known host fishes include widespread species including Redhorse, Sucker species and Rock Bass. Rock Bass, Shorthead Redhorse, Golden Redhorse, White Sucker, were present throughout the Study Area. Silver Redhorse, Northern Hog Sucker, and Lake Chub Sucker were only captured below Balsam Row. The number of mussel's present may be too low to provide for adequate recruitment of the population.
- The Snuffbox mussel (Federal Endangered) is found in very clean water of large to medium-sized streams in large riffle areas. It is limited in distribution in Wisconsin to the Wolf and St Croix rivers. The known fish hosts are the Logperch and Banded Sculpin. Snuffbox has been observed below Shawano Paper Mill Dam.

The combined presence of natural habitat and man-made disturbances must be taken into consideration to evaluate whether there is a likelihood that rare species are present and the potential for impacts to those species.

The Tribe also protects Sturgeon species from harvest within the reservation. Other species are also protected, including Wolverine, Badger, Flying-Squirrel, Timber Wolf, Canada Lynx, Moose, Elk, Buffalo,

Cougar, Pine Marten, all raptors including all species of eagles and hawks, swans, cranes, Kingfisher, Great Blue Heron, bitterns, plovers, Sand Pipers, loons and grebes. (<http://www.menominee-nsn.gov>)

Aquatic Habitat Summary

Habitat type is a significant determinant for the species of fish, mussels, aquatic plants and insects that live in various portions of the Wolf River. The Study Area was found to have five distinct habitat zones; two impoundments and three riverine reaches (Figure 8). The two impoundments are the ponds upstream of the Shawano Paper Mill and Balsam Row Dams. Two of the riverine reaches (rocky and depositional reaches) lie between the upstream extent of the Balsam Row Pond and Keshena Falls. The other riverine reach occurs between the furthest upstream extent of the Shawano Paper Mill Dam Pond and just below the Balsam Row Dam.

To provide appropriate biotic index comparisons, upstream and downstream sample sites for both wadable and non-wadable habitat were selected based on similarity of habitat. See Appendix H for specific methodology and results for the 2016 habitat surveys.

Rocky reach is the most upstream riverine reach extends from Keshena Falls down to approximately Fairgrounds Road. This reach consists of riffles and pools with a few moderately deep runs. Water depth in the riffles and runs ranges from 1-4 feet, while the pools are up to 8 feet deep. The substrate in the channel is rocky and is primarily a complex of sand, gravel, cobble, and boulders. Along the stream margins, coarse woody habitat along with emergent and submergent vegetation provide additional cover for fish.

The diversity of river features in this upstream rocky reach provides for a greater complexity of habitat within the Study Area as compared to the other downstream reaches. The two tributaries that enter the Wolf River within this reach (Chickney and Oshkosh Creeks) provide high quality habitat and seasonal usage by aquatic species. Submergent vegetation is limited to depositional areas along the river margins and backwater sloughs.

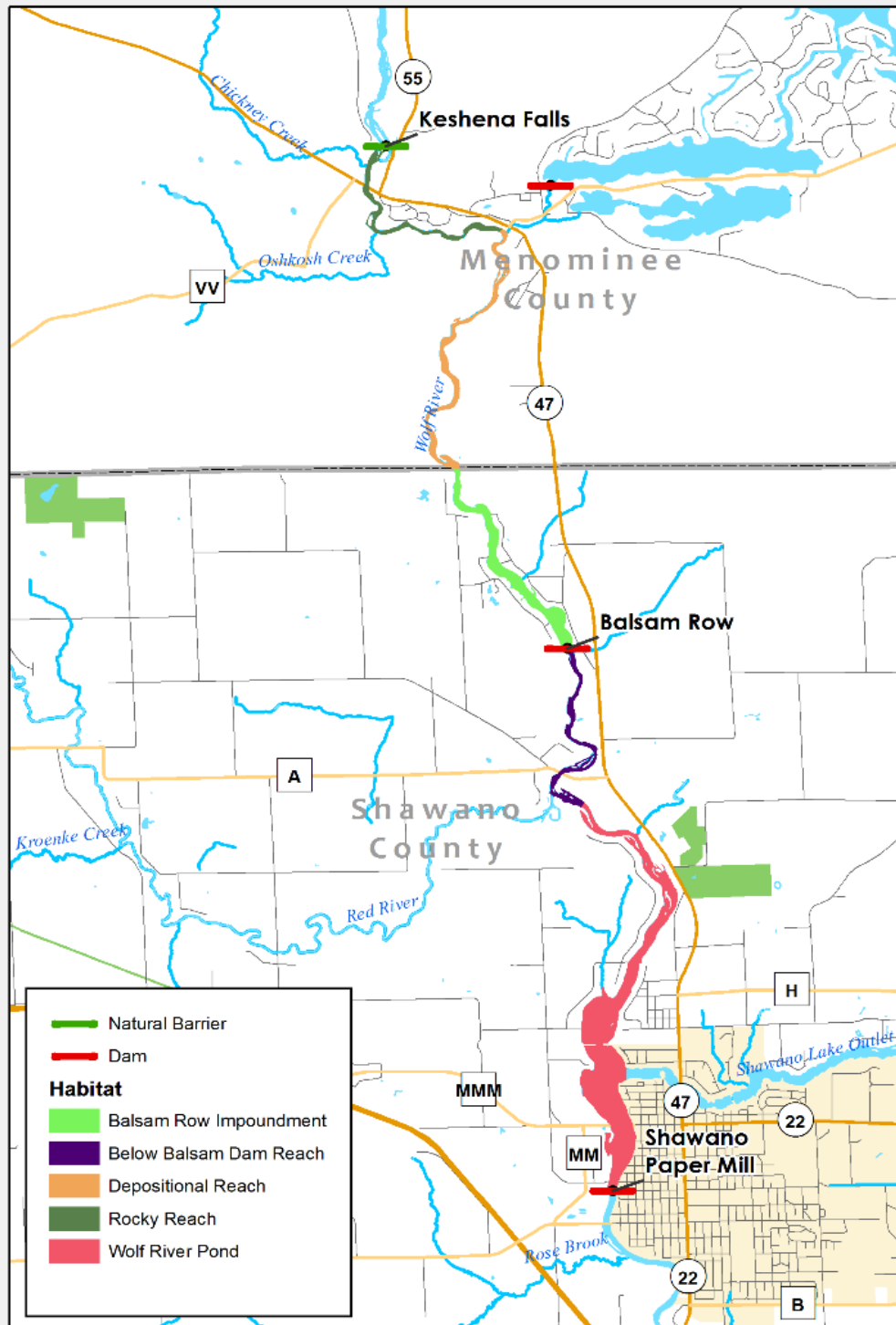


Figure 8 Locations of Habitat Segments

Depositional reach is located between the upstream rocky reach and the Balsam Row Pond is a zone with lower stream gradient and velocity. This is a depositional area for sediments moving downstream. This reach extends from Fairgrounds Road to approximately the Menominee/Shawano County line. This portion of the river is mostly a run with 2-4 feet of depth and deeper pools up to 9 feet deep on the outside bends. Substrate through this reach is dominated by sand, however silt and organic detritus is common along the stream margins, point bars, and backwater sloughs. Along the stream margins and backwater sloughs, Wild Rice beds with other emergent plants are common. Also present are Water Lilies, Water Celery, and native pondweeds.

Habitat within this reach is directly affected by deposition of sand throughout the entire reach. According to a USGS report (Fitzpatrick 2005), it appears that most of the sand deposited in the depositional reach resulted from the impounding effects of the Balsam Row Dam. The origin of the sand is a result of historic logging operations, and the failure of the Keshena Falls Dam (Fitzpatrick 2005).

Keshena Creek, which enters the Wolf River at the start of the depositional reach, is a cool-warm mainstem tributary, within this depositional reach, that provides good habitat and seasonal usage by an array of Wolf River aquatic species.

Balsam Row Pond is a narrow, shallow impoundment upstream of the Balsam Row Dam. The pond lies between the depositional zone and the Balsam Row Dam. The mean depth of the pond is five feet, with a maximum depth of 14 feet. Bottom substrate consists mostly of fine sand, silt and clays with pockets of organic detritus. Some areas of exposed gravel exist but the extent of this substrate type is limited. Habitat within the pond is comprised of mainly submergent and emergent aquatic plant beds, typical of a flowing riverine system, with emergent plants limited to the narrow near shore banks, and submergent plants more prevalent in more protected areas away from the original river channel.

The portion of the Balsam Row Pond that emulates more of a lake-like habitat has 67% of its shoreline developed. However, there may be impounding effects up as far as Kittecon Road based on the dynamic change in fish community near the Menominee the county line.

Riverine reach downstream of Balsam Row Dam is 1.5 miles long. The first 0.25 miles downstream of the dam consists of riffle and fast run with a mean depth of 1-3 feet. This short stretch of river is highly influenced by the tail water of the Balsam Row Dam. Fallen trees and overhanging woody vegetation provide the most important habitat features within this reach. The substrate here is comprised of cobble, boulder, and gravel that are minimally embedded into coarse sand.

For the next 1.25 miles, fine sand, silt, clay and detritus become the dominant substrates, especially along the stream margins, point bar deposits, and backwater sloughs. The river turns into a slow run with pools as it approaches CTH A with an average water depth of 3-5 feet. Submergent plant beds are sparse within the main channel but present in backwater slough areas. The impounding effects of the Wolf River Pond begin around CTH A. Fish cover is comparable to the first 0.25 miles of this segment with woody debris and overhanging vegetation as the dominant cover for fish.

Wolf River Pond is an impoundment of the Wolf River above the Shawano Paper Mill Dam. The pond is also connected to Shawano Lake via the Shawano Lake Outlet Channel. The Wolf River Pond has a maximum depth of 14 feet with a mean depth of 6 feet. Bottom substrate consists mostly of fine sand, silt and clays with pockets of organic deposits. Some gravel and cobble are present and is usually associated with human influence such as rip-rap or access locations. Wolf River Pond is a larger impoundment above the Shawano Paper Mill Dam. The defined area of the Wolf River Pond was determined using the Department's Surface Water Data Viewer (SWDV) to assign the developed vs non-developed areas. The Shawano Dam likely influences the Wolf River Pond up to the Balsam Row Pond, but the SWDV delineates the impoundment up to about the Wolf River Road on the west side of the River. Approximately 75% of the shoreline within the Wolf River Pond is developed.

The Red River enters the Wolf River Pond from the northwest in this segment. Red River provides excellent habitat and there is likely significant interaction between aquatic species that reside within the Wolf River and the Red River. The Red River is considered cool/warmwater with clear water that consists of riffles and pools with a few moderately deep runs. Water depth in the riffles and runs ranges from 1-4 feet, while the pools are up to 8 feet deep. It provides excellent habitat comprised of cool/warm water, clear water with sand and gravel, riffles and pools, with good shoreline vegetative cover. The substrate in the channels is composed primarily of gravel substrates with sparse to moderate beds of instream vegetation. Primary cover consists of large woody structure, overhanging vegetation and boulders. The Red River likely acts as a source of refuge for riverine fish and mussel species.

The unnamed tributary above Wolf River Road is significantly impacted by degraded habitat. The small tributary appears to have been historically dredged and straightened for agricultural purposes. Currently it has poor riparian buffers and excessive build-up of fines, little cover for fish and monotypic habitat, conditions suitable for the reproduction and recruitment of Common Carp.

Water Quality Summary

The Department may designate as Exceptional Resource Waters (ERW) those surface waters which provide outstanding recreational opportunities, support valuable fish and wildlife habitat, have good water quality, and are not significantly impacted by human activities. ERW status identifies waters that the State of Wisconsin has determined warrant additional protection from the effects of pollution. The MITW also applies a special designation, Outstanding Menominee Resource Waters, to all surface waters within the reservation boundaries.

- The Red River (WBIC 326600) enters the Wolf River from the west 3.8 mi. above the Shawano Dam. This 47-mile-long tributary contains classified trout water, designated as Class III from the mouth to 11.8 miles upstream, and continues as Class II/I upstream.
- Alcohol Creek (WBIC 3390000), in the West Branch Wolf River Watershed, is a 1.59-mile-long tributary that falls in Shawano County and enters the Wolf River from the east just below Balsam Row Dam. This tributary has ERW designation and is a Class I trout water. This river is managed for fishing and swimming and is currently not considered impaired.

- Chickney Creek (WBIC 341500) is a 2.3-mile-long tributary that enters the Wolf River from the west just south of Keshena Falls. Chickney Creek is an ERW designated water and a Class I trout water.
- Oshkosh Creek (WBIC 341100) is a 2.4-mile-long tributary that enters the Wolf River from the west just south of Keshena Falls (approximately 0.5 mile south of confluence with Chickney Creek). Oshkosh Creek is an ERW designated water and a Class I trout water.

The quality of water within a river is important for determining the biological community the river can support. Land use throughout the Wolf River watershed and modifications to river flows by the Shawano Paper Mill and Balsam Row Dams also affect the habitat and water quality that support the river ecosystem. The water chemistry in the Wolf River was evaluated above and below the Balsam Row Dam during 2016.

As part of the 2016 survey, basic water quality data was collected; including air temperature, water temperature, conductivity, dissolved oxygen, dissolved oxygen percent, pH, and water clarity. Surface water grab samples were analyzed by the State Lab of Hygiene for total phosphorous, orthophosphate, total suspended solids (TSS), total Kjeldahl nitrogen, nitrate-nitrite, and ammonia. The water chemistry parameters collected were reviewed and evaluated against the Department's listing methodology for impaired waters (WDNR 2016). No significant impairments resulting from environmental degradation from excessive nutrients, suspended solids, or temperature are occurring. The median total phosphorous concentration for both sites (above and below Balsam Row Dam) is well below the 0.1 mg/l listing recommendation, and total suspended solids (TSS) are below the proposed target goal listed in the Upper Fox and Wolf River TMDL (DRAFT, 2018) of 12 mg/l.

Based on 2016 data, the mean monthly summer maximum temperatures were 22.03 °C above Balsam Row Dam and 21.56 °C below Balsam Row Dam. Continuous temperature readings at both stations indicate that surface water temperatures were below the ambient temperature criteria for warm-large rivers in June, July, and August. Overall differences in water temperature are minimal and will not adversely affect aquatic organisms (See Appendix G).

TSS during the sampling period were consistently low. The mean TSS concentration above Balsam Row Dam was 5.16 mg/l and was 6.50 mg/l below Balsam Row Dam. TSS were lower than the proposed target of 12 mg/l in the Upper Fox and Wolf River TMDL (DRAFT, 2018). The TSS concentrations are not of a magnitude which would adversely affect aquatic organisms.

The median total phosphorous concentration for both sites was well below the 0.1 mg/l State Water Quality Criteria. There were small variations in nitrogen parameters collected upstream and downstream of the Balsam Row Dam, but the concentrations were not of a magnitude which would adversely affect aquatic organisms.

Dissolved oxygen concentrations averaged 2 mg/l higher above the Balsam Row Dam than below but were never observed below the 5 mg/l State Water Quality Criteria for these waters.

Overall, there were only very minor differences between the water quality data collected upstream and downstream of the Balsam Row Dam, and these were not of a magnitude which would adversely affect aquatic organisms. The hydrologic modifications of the Wolf River by the Shawano Paper Mill and Balsam Row Dams have minor impacts on most of the chemical (e.g. nutrients, dissolved oxygen) dynamics of the Wolf River ecosystem.

Aquatic Plants Summary

Aquatic plants (macrophytes) form the foundation of healthy lake and river ecosystems. Aquatic plants are a lake's internal filtering system. By absorbing nutrients like phosphorus and nitrogen, they limit the production of algae and help keep the water clear. Aquatic plants protect water quality by stabilizing soft lake bottoms and prevent shoreline erosion by reducing the effect of waves and currents, eliminating or reducing turbidity. Healthy native aquatic plant communities may also help prevent the establishment of invasive plants. Aquatic plants also provide important reproductive, food, and cover habitat for fish, invertebrates, and wildlife.

Aquatic plant data collection occurred in both the Wolf River Pond and Balsam Row Pond. Data was not collected within the riverine sections of the Study Area. Data collection ended at the northern end of the Shawano County line.

Due to differences in hydrology and physiology (i.e. waterbody width, flow rates, sediment type), it would not be appropriate to make direct comparisons between the aquatic plant communities in Balsam Row Pond versus the Wolf River Pond. The following summaries describe the aquatic plant communities present within the ponds (see Appendix J).

The aquatic plant community in the Balsam Row Pond is more typical of a flowing riverine system, with emergent and submerged plants limited to the narrow near shore banks and more protected areas away from the original river channel. Dominant native aquatic plant species found include: Wild Celery, Flat-Stem Pondweed, Coontail, Common Waterweed, White Water Lily, Northern Wild Rice, Bur-reed, and River Bulrush (Figure 9). These species are generally intolerant to moderately tolerant of anthropogenic disturbance, and despite the relatively low species diversity and frequency, it represents a relatively undisturbed riverine system. The presence of Wild Rice and Bur-reeds, both species which are generally classified as being relatively intolerant to disturbance, was more prevalent in Balsam Row Pond. Non-native plant species detected include Eurasian Watermilfoil, Purple Loosestrife, Narrow-Leaf Cattail, and Aquatic Forget-Me-Not (See Appendix J).

The aquatic plant community in the Wolf River Pond is more typical of a lake or slower-moving flowage, and plants can grow throughout the majority of the waterbody, except for the deeper reaches of the original river channel. Dominant native aquatic plant species observed in Wolf River Pond include: Common Waterweed, Coontail, Flat-stem Pondweed, Common Watermeal, Small Duckweed, Forked Duckweed, Wild Celery, and Stonewort (Figure 10). These species are moderately to highly tolerant of disturbance, and their presence indicates that there are environmental or anthropogenic stressors impacting the ecosystem. Also dominant is the non-native, invasive Eurasian Watermilfoil. (See Appendix J).

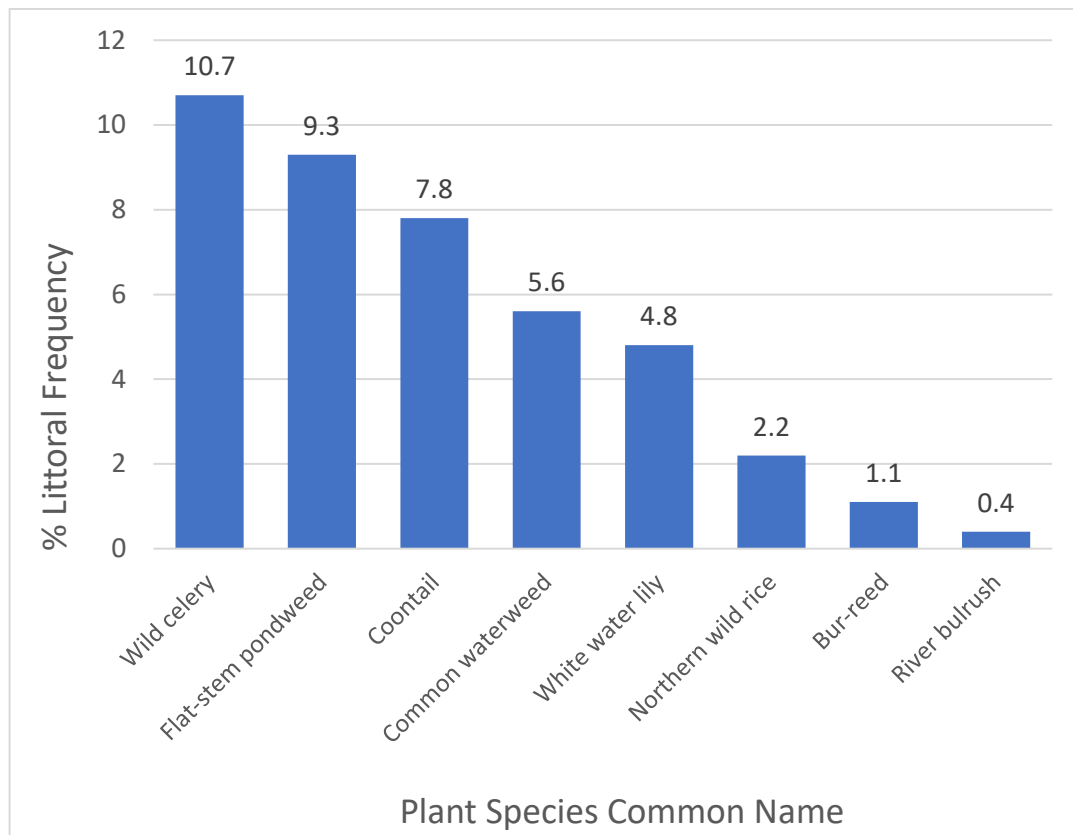


Figure 9 Percent Littoral Frequency of Aquatic Plant Species Found in Balsam Row Pond

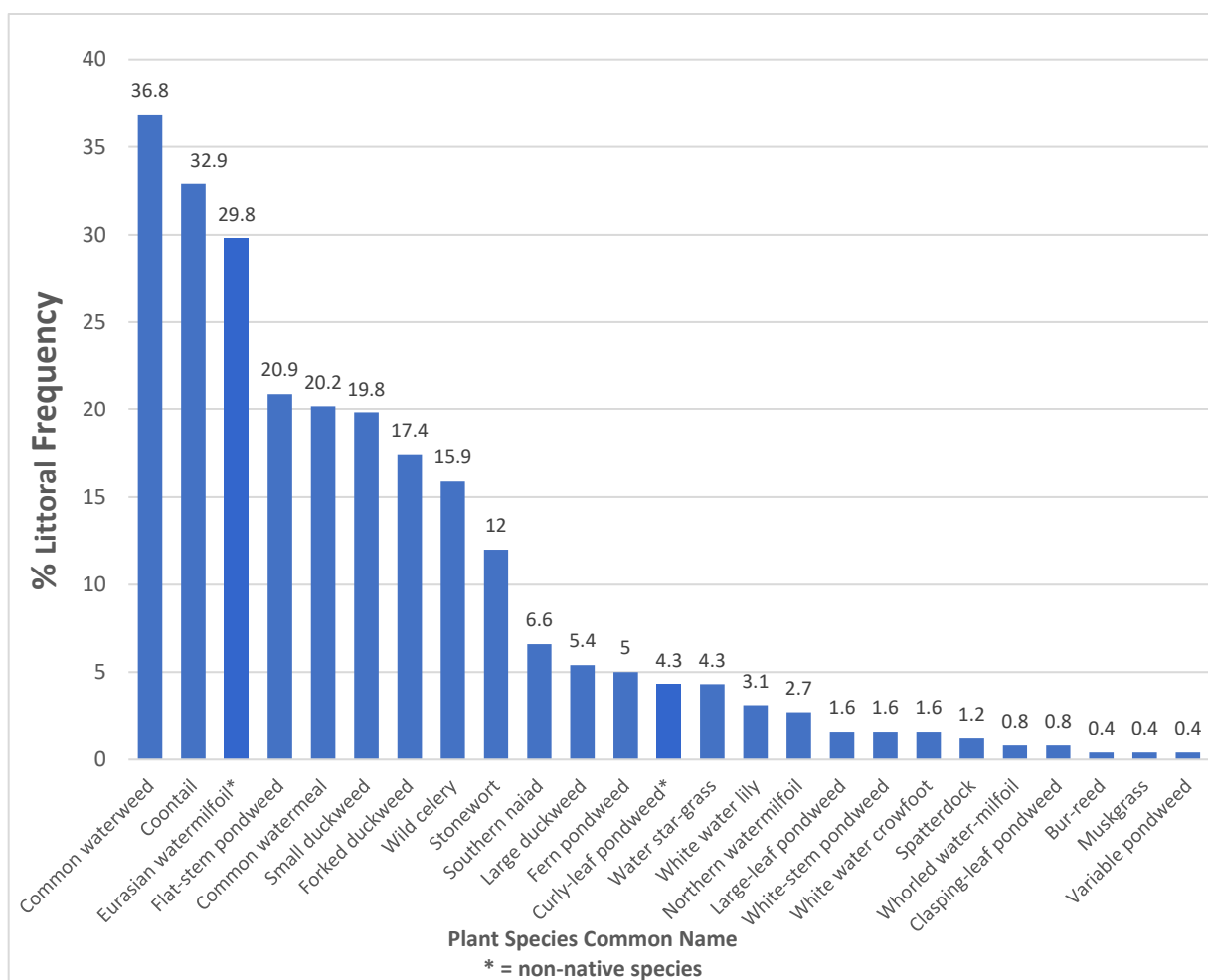


Figure 10 Percent Littoral Frequency of Aquatic Plant Species Found in Wolf River Pond

Aquatic plants were also observed during habitat surveys on the Wolf River. Within the depositional reach and along the stream margins and backwater sloughs, Wild Rice beds and Purple Loosestrife with other emergent plant species were common. The open water margins of these backwater and stream margin areas support dense plant beds of Lilies, Water Celery, and native pondweeds.

Within the riverine reach below Balsam Row Dam the aquatic plant communities consisted of Water Celery and pondweeds along with various other emergent species along the river margins (Appendix H).

Aquatic Insect Summary

The Wolf River from Keshena Falls downstream to the Balsam Row Dam and downstream towards the Shawano Paper Mill Dam provided unique challenges in the collection and interpretation of the aquatic insect IBI metrics for both the wadable and non-wadable portion of the river. The Wolf River near Keshena and downstream to approximately the Menominee County line is marginally wadable with portions of non-wadable pools and runs mixed throughout. At approximately the Menominee/Shawano County line, the zone of influence from the Balsam Row Dam causes a shift from a lotic to a lentic system and associated characteristics. Immediately downstream of the Balsam Row Dam there is a short 400-meter section of wadable river that exhibit strong lotic characteristics.

In an attempt to provide the greatest range of metric and biotic index comparisons, both non-wadable and wadable collections of insect samples were taken from nearly identical habitat features. The wadable insect samples were collected from swift rock riffle habitat and the Hester-Dendy samplers were placed within deep runs with similar velocities, similar substrates, and within similar proximity to large course woody debris structures.

There were a number of mayflies, (Ephemeroptera), stoneflies, (Plecoptera), and caddisfly (Trichoptera) found at upstream sites that were not observed, or very rarely observed downstream. In general, species found within these orders generally have lower pollution tolerance values and are considered intolerant species. Comparing the Hilsenhoff's Biotic Index (HBI) and Macroinvertebrate Index of Biotic Integrity (M-IBI) scores reveal the scores upstream of the Balsam Row Dam are slightly better than below the dam (Table 3).

Table 3 Aquatic Insect Diversity Metrics at Riverine Sites Within the Wolf River Study Area

Protocol Type	Non-Wadable		Wadable	
Stream – Site	Wolf River @ CTH A	Wolf River 675 m D/S of STH 47 Bridge	Wolf River D/S Balsam Row Dam	Wolf River 275 m D/S of STH 47 Bridge
HBI Rating <i>Good = 4.51-5.5, Very Good = 3.51-4.5</i>	Good	Good	Very Good	Very Good
HBI Score	5.46	4.55	4.18	3.56
MIBI Rating <i>Excellent = 7.5-10</i>	NA	NA	Excellent	Excellent
MIBI Score	NA	NA	9.49	9.67
Non-Wadeable IBI Rating <i>Good = 50-75, Excellent > 75</i>	Good	Excellent	NA	NA
Non-Wadeable IBI Score ³	65	85	NA	NA
%EPT	52	41	65	48
Mean Pollution Tolerance Value	5.5	4.7	3.7	4.3
Species Richness	34	41	46	34

Sites scored a range of good to excellent water quality conditions. The differences between the scores may be relative to the presence or absence of a sensitive species or the relative abundance of some other species that are found at both locations.

Species richness and mean pollution tolerance values are lower upstream of the Balsam Row Dam when considering both the non-wadable and wadable samples. However, the difference between the two scores is negligible.

Many of the EPT species are observed in very low abundance and typically only a single individual of a species is identified within the collected sample. In theory, slight differences in metrics between the sampling locations is a function of the habitat sampled and not a derivative of Balsam Row Dam. As stated earlier, sample locations were identified and selected to give the best representation for comparative samples. Even with this intent, there were slight variations to the habitat sampled and the placement of the Hester-Dendy samplers that could explain species variability between the upstream and downstream scores and comparative metrics. Overall, the insect communities and biotic metrics were very similar both above and below Balsam Row Dam.

Freshwater Mussel Summary

Freshwater mussels are ecologically important in many ways, including as a source of food for mammals, fish and birds. As biofilters siphoning many gallons of water a day, they provide nutrient and energy cycling in streams and lakes by filtering algae, bacteria, and organic matter from the water column providing nutrients to many other organisms (Vaughn and Hakenkamp 2001). Mussels provide structural habitat for other organisms and have been shown to significantly increase density of other macroinvertebrates (Vaughn and Spooner 2006). Mussels have also been reported to help stabilize sediments within mussel beds (Strayer et al. 2004). The distribution of virtually all freshwater mussels is directly linked and highly dependent upon host fish species (Cummins and Mayer 1992; OSU 2015).

Mussels are sensitive to a wide variety of environmental and anthropogenic stressors. They can be impacted by pollution, sediments, and hydrologic modification, which can also impact their host fish. Mussel distribution can also be inhibited by fragmented habitat and physical barriers that limit the distribution of host fish used by mussels. (Watters 1996; Watters 1999; Vaughn and Taylor 1999; Dean et al. 2002).

The entire Wolf River system supports a diverse mussel community with recent surveys recording 28 species (Mathiak 1979; WDNR unpublished data). Historically, 19 species have been observed within the Study Area. In 2014 and 2016, sampling collected 11 species below Balsam Row Dam and 12 species above Balsam Row Dam (Table 4). The number of species collected per sample site ranged from 9 to 12. Relative to the entire Wolf River system, there is less mussel diversity and juvenile recruitment levels within the Study Area.

Mean mussel density averaged 17.6 mussels/m² below Balsam Row Dam compared to 8.9 mussels/m² above Balsam Row Dam. Mean mussel diversity decreased by 45 percent above Balsam Row Dam. Mussel densities in the Study Area of the Wolf River varied by section but are within the ranges for other diverse rivers in Wisconsin.

Juvenile mussels (less than 4 years old) were observed for 8 species below Balsam Row Dam and 5 species above Balsam Row Dam. Juvenile mussels accounted for only 2.4 percent of all individuals

collected, with juvenile density ranging from 0.40 to 0.84 juveniles/m² per site and is comparable to other rivers of this size and type in Wisconsin. Juvenile recruitment can be considered low for most species with only one or two individuals collected.

Table 4 Recent (R;2014-2016) and Historical (H:1973-1996) Occurrences of Mussel Species in the Wolf River Study Area

Mussel Species	Below Balsam Row Dam	Above Balsam Row Dam	Host Fish Species
Mucket (<i>Actinonaias ligamentina</i>)	HR	HR	Black Crappie, Rock Bass, Smallmouth Bass
Slippershell (<i>Alasmidonta viridis</i>)	HR	HR	Johnny Darter, Mottled Sculpin
Elktoe (<i>Alasmidonta marginata</i>)	HR	HR	Northern Hog Sucker, Rock Bass, Shorthead Redhorse, White Sucker
Cylindrical papershell (<i>Anodontoides ferussacianus</i>)		HR	Banded Darter, Black Crappie, Blackside Darter, Bluegill, Fantail Darter, Rainbow Darter, Slenderhead Darter
Spike (<i>Elliptio dilatata</i>)	HR	HR	Largemouth Bass, Mottled Sculpin, Rock Bass, Yellow Perch
Wabash pigtoe (<i>Fusconaia flava</i>)	HR	HR	Blackchin Darter, Blacknose Shiner, Common Shiner, Emerald Shiner, Golden Shiner, Mimic Shiner, Rosyface Shiner, Weed Shiner
Fat Mucket (<i>Lampsilis siliquoidea</i>)	HR	HR	Bluegill, Rock Bass, Smallmouth Bass, Walleye
Plain Pocketbook (<i>Lampsilis cardium</i>)	HR	HR	Largemouth Bass, Smallmouth Bass, Yellow Perch
Flutedshell (<i>Lasmigona costata</i>)	HR	HR	Banded Darter, Blackside Darter, Bluegill, Common Carp, Fantail Darter, Johnny Darter, Longnose Dace, Northern Hog Sucker, Northern Pike, Rainbow Darter, Slenderhead Darter, Walleye, Yellow Perch
Black sandshell (<i>Ligumia recta</i>)	HR	HR	Largemouth Bass
Round pigtoe (<i>Pleurobema sintoxia</i>)	HR	R (dead shell only)	Bluntnose Minnow, Common Shiner, Creek Chub, Hornyhead Chub, Northern Redbelly Dace, Spotfin Shiner
Creeper (<i>Strophitus undulatus</i>)	HR	HR	Banded Darter, Blackchin Darter, Blacknose Shiner, Common Shiner, Emerald Shiner, Fantail Darter, Fathead Minnow, Golden Shiner, Johnny Darter, Mimic Shiner, Rainbow Darter, Rosyface Shiner, Sand Shiner, Slenderhead Darter, Spotfin Shiner, Walleye, Weed Shiner
Threeridge (<i>Amblema plicata</i>)	H		Largemouth Bass, Pumpkin Seed, Yellow Perch

Giant Floater (<i>Pyganodon grandis</i>)	H		Bluegill, Creek Chub, Largemouth Bass
Creek heelsplitter (<i>Lasmigona compressa</i>)	H		Black Crappie, Mottled Sculpin, Spotfin Shiner, Yellow Perch
Pimpleback (<i>Quadrula pustulosa</i>)	H		Brown Bullhead, Yellow Bullhead
Salamander Mussel (<i>Simpsonaias ambigua</i>)	H		Mudpuppy
Paper pondshell (<i>Utterbackia imbecillis</i>)	H		Bluegill, Largemouth Bass, Rosyface Shiner
Pink heelsplitter (<i>Potamilus alatus</i>)	H		Freshwater Drum (not observed in Study Area)

Table 5 Recent and Historical Mussel Observations Between Balsam Row Dam and Shawano Paper Mill Dam, Including Juveniles (in parentheses) and Dead Shells (x)

Downstream of Balsam Row Dam, River Miles 110.0 – 114.15									
	1973	1975	1989	1991	1992	1993	1994	1995	2014/2016
Mucket	0	0	87	403	1024	70	92	32	202
Elktoe	1	0	15	5	21	1	3	2	9
Slippershell	0	0	13 (X)	49 (36)	20	4	2	1	3
Threeridge	0	0	1 (1)	2	0	0	0	0	0
Spike	0	0	290	1812 (6)	5953 (1)	397 (2)	773	278	2644
Wabash Pigtoe	1	0	19	134	163	9	29	10	21
Pocketbook	0	0	47 (2)	93	183	8	18	3	55
Fat Mucket	2	1	100 (1)	112	179	7	41	2	86
Creek Heelsplitter	0	0	0	0	1	0	0	0	0
Fluted Shell	0	0	97	155	374	18	44	14	175
Black Sandshell	0	0	19 (1)	67	169	9	21	4	35
Round Pigtoe	0	0	2	8	38	5	7	0	3
Pink Heelsplitter	0	0	2	0	0	0	0	0	0
Giant Floater	0	0	3	94	3	0	0	0	0
Pimpleback	0	0	0	0	0	0	1	0	0
Salamander Mussel	1	0	8 (13)	7 (12)	15 (7)	0	2	0	0
Creeper	0	0	49	42	193 (1)	12	21	11	25
Paper Pondshell	0	0	0	0	0	1	0	0	0

Table 6 Recent and Historical Mussel Observations Between Balsam Row Dam and Keshena Falls, Including Juveniles (), and Dead Shells(x)

	1988	1996	2014/2016
Mucket	4	2	1
Elktoe	3	3	5 (X)
Slippershell	12 (1)	3	36
Cylindrical Papershell	1	0	3
Spike	320	70	1449
Wabash Pigtoe	3 (2)	3 (1)	80
Pocketbook	11 (3)	2	44 (X)
Fat Mucklets	5	0	56
Fluted	3 (1)	11	7
Black sandshell	8 (2)	0 (3)	1 (X)
Creeper	5	0	0
Round Pigtoe	0	0	X
Paper Pondshell	0	0	46

Historically, some mussel species have been observed in limited numbers (Table 5 & 6). Low numbers could be a result of lack of habitat or host species, regional or seasonal flood events, predation, and changes in habitat or water quality. In some cases, single observations could also indicate a misidentification of species. Survey locations can have significant influence on the ability to collect sufficient data for a variety of species. Different mussel species prefer different habitats, and a single survey location may not represent a mussel population.

Fisheries Summary

Many of Wisconsin's large river fish species make long migrations to reach spawning, summer feeding, and over-wintering habitats (Priegle 1970; Kempinger 1988; Langhurst and Schoenike 1990; Pellet et al. 1998). Other riverine species have evolved to spawn on certain substrates with narrow limits for depth and velocity (Trautman 1957; Becker 1983).

In some cases, dams have been shown to have negative impacts on the biological communities in many of North America's large rivers (Karr et al. 1985; Travnicek et al 1995) including those in Wisconsin (Becker 1983; Lyons et al. 2001; Piette 2004). Fragmentation of riverine habitat has led to declines in native riverine fish species (Poddubny and Galat 1995; Collier et al 1996) due to losses of suitable habitat and blockage of migrations. Disruptions by dams change the natural continuum of the biotic community and shift the natural patterns within rivers. The extent of the shifts depends upon the position of the dam within the watershed and the flow regulation from the dam (Ward and Stanford 1983). Depending on the severity of the disruption, at some distance downstream, rivers are thought to return to their natural longitudinal patterns (Kinsolving and Bain 1993).

Fisheries assessments were conducted in Wolf River Pond (in 2014), and in Balsam Row Pond, riverine sections and tributary streams within the Study Area (in 2016) following the Department's Fisheries Management Handbook protocols. In addition, non-standard protocol gears (seine nets) were

employed within the riverine sampling sites to ensure maximum coverage of the Study Area and to ensure all habitats within the riverine corridor were represented. The overall goals of the fish surveys were to determine the status of the existing fish community and if there were any significant differences in the fish communities above and below the Balsam Row Dam. Historical records were also summarized to gain an understanding of changes in fish distribution over time.

Non-Game Fish Summary

The non-game species present, species richness, and the species assemblages were different above and below the Balsam Row Dam. Even though there were differences in richness and assemblage, the biotic integrity scores rated all Wolf River riverine sample sites as excellent. The three cold/cool water tributaries above the Balsam Row Dam contained fish species typical of these types of stream and scored excellent via the index of biotic integrity. The three tributaries of the Wolf River between the dams are variable with biotic integrity scores ranging from poor to excellent.

Non-wadeable electrofishing surveys conducted in the riverine sections of the Study Area indicated diverse and healthy fish communities in the river. A total of 730 fish were captured representing 26 species. The riverine survey site located just above the Balsam Row Pond had the fewest number of species. This may be due in part to the reduced riverine habitat and increased sediment deposition in the upper reaches of the reservoir. The greatest diversity by species was at the farthest upstream site at Keshena (21 species captured), followed by the most downstream site below Balsam Row Dam (20 species), and finally at the sample site above the Balsam Row Pond (15 species). This same order of sites (Keshena, below Balsam Row Dam, above Balsam Row Pond) was true for the number of riverine specialist species found during non-wadable sampling; 10, 8 and 5 species, respectively. Catches of riverine species such as Hornyhead Chub, Northern Hog Sucker, Golden Redhorse and Blackside Darter were lower below Balsam Row Dam compared to above the dam (Table 7).

Biotic integrity scores rated excellent at all three sites with scores of 95 at Keshena, 85 Upper Balsam, and 100 Lower Balsam.

- The survey site Lower Balsam rated higher than expected based on observed habitat for riverine species within the reach. This was likely due to the influence of the Red River joining the Wolf River just downstream of the survey reach, which provides additional spawning habitat, and rearing habitat for riverine fishes.
- The survey site Upper Balsam had the lowest IBI score (85) with the fewest number of species. Low numbers of riverine specialist and intolerant species are likely due to reduced riverine habitat resulting from increased deposition in the upper reaches of the reservoir resulting in extensive sand flats within the main channel. The number of darter species was less than in the Upper Balsam reach compared to the other two sites, while overall number of darter individuals was lowest in the Lower Balsam site. Both riverine sites were influenced by the pond.
- The percentage of simple lithophilous spawners by number was greatest for Keshena Falls survey site at 83%, followed by Upper Balsam at 70% and Lower Balsam at 58%. The most common species captured in the section Upper Balsam by number were Golden Redhorse,

Common Shiner, Shorthead Redhorse, Northern Hog Sucker and Logperch. One of these is a species of particular importance is the Logperch, which is the host for the federally endangered Snuffbox mussel. The Logperch had a relative abundance of 12% at the Keshena site compared to 5% at Upper Balsam and 2% at Lower Balsam. However, habitat above the dam is more suitable for Logperch than below.

Silver Redhorse, a species that is a potential host for the State listed Elktoe Mussel, was captured in riverine sampling sites below Balsam Row Dam and in the Wolf River Pond and are commonly captured during sampling below the Shawano Paper Mill Dam. Habitat exists above the Balsam Row Dam based on substrate type and the presence of deeper pools and runs. Past fish distribution records (Fago 1992; WDNR Fish Mapping Application 2017) show a possible occurrence found near the Shawano – Menominee County line as recently as 2011 so it is possible that a very small population does exist above the Balsam Row Dam, but their population numbers may be so low that observations are unlikely.

Table 7 Summary of Fish Species Captured by All Gear Types in 2014 and 2016 Fish Assessments. For Riverine Site Catches, Bold x = Captured Both by Seining and Electrofishing, Bold x=Captured Only By Seining, x=Captured by Electrofishing Gear Only*

Species	Wolf River Below BRD	Wolf River Above BRD	Wolf River Pond (Below BRD)	Balsam Row Pond (Above BRD)	Tribs Below BRD	Tribs Above BRD
Banded Darter	x	x			x	
Black Bullhead			X	x		x
Black Crappie	x		X	x		
Blacknose Dace						x
Blacknose Shiner		x*				
Blackside Darter	x	x			x	x
Bluegill	x	x	X	x	x	x
Bluegill/Pumpkinseed Hybrid						x
Bluntnose Minnow	x	x				
Bowfin			X			
Brassy Minnow	x*	x*				
Brook Silverside	x					
Brook Stickleback					x	
Brook Trout					x	x
Brown Bullhead			X			
Brown Trout		x				x
Central Mudminnow					x	x
Central Stoneroller	x	x			x	x
Common Carp (invasive)	x		X		x	
Common Shiner	x*	x	X	x	x	x
Creek Chub		x*				x

Fantail Darter					x	x
Fathead Minnow					x	
Golden Redhorse	x	x	X	x		
Golden Shiner	x*	x*	X			
Hornyhead Chub	x	x				x
Johnny Darter		x			x	x
Lake Chubsucker			X			
Lamprey Ammocoete					x	
Largemouth Bass	x	x	X	x	x	
Logperch	x	x			x	x
Longnose Dace		x			x	
Mimic Shiner	x*					
Mottled Sculpin						x
Muskellunge		x	X			
N Brook Lamprey		x				
N. Hog Sucker	x	x			x	x
Northern Pike	x	x	X	x		x
Northern Redbelly Dace					x	x
Pearl Dace						x
Pumpkinseed	x*		X	x		
Rock Bass	x	x	X	x	x	
Rosyface Shiner	x*	x			x	x
Sand Shiner		x*				
Shorthead Redhorse	x	x	X	x	x	x
Silver Redhorse	x		X			
Slenderhead Darter	x	x				
Smallmouth Bass	x	x	X	x	x	
Tadpole Madtom	x*					
Walleye	x	x	X	x		
Weed Shiner	x*	x*				
White Sucker	x	x	X	x	x	x
Yellow Bullhead			X	x		x
Yellow Perch			X	x		

Some riverine species such as Hornyhead Chub, Northern Hog Sucker, Golden Redhorse, Blackside Darter and Logperch were found in greater abundance above the Balsam Row Dam compared to below. This suggests that adequate habitat does exist for these riverine species to live and reproduce in this section of river.

Tributaries above and below the Balsam Row Dam varied greatly in their fish community assemblages. The three streams sampled above the Balsam Row Dam scored IBI ratings of excellent (ranging from 90-

100). The quality of these streams is directly related to the localized watersheds that are intact with limited human disturbances. These tributaries contained a mix of cold/cool water and intolerant fish species such as Brook and Brown Trout, Mottled Sculpin, Central Mudminnow, Central Stone Roller, White Sucker, Common Shiner, several darter species, Shorthead Redhorse and Bluegill. These tributaries likely provide additional habitat to the fish community observed in this reach of the Wolf River.

The tributaries sampled below the Balsam Row Dam were much more variable in their IBI scores, ranking from poor to excellent. This range of scores was the result of the fish communities present, which in turn was a reflection on the habitat quality in the tributaries. The IBI score for Alcohol Creek ranked fair. The fish community had both cool and warmwater species and the catch was dominated by tolerant fish species. The IBI score for the Red River ranked excellent. Seventeen species were captured in 2016 of which 6 are intolerant to environmental degradation. It is likely that the Wolf River Pond serves as important overwintering habitat for Smallmouth Bass and panfish in the waters below Balsam Row Dam. The IBI score for the Unnamed Tributary (WBIC 5012829) to Wolf River Pond ranked poor. The fish community was composed mostly of fish which are tolerant of degraded environments.

The Balsam Row Dam and Shawano Paper Mill Dam represent barriers that influence fish migration within this section of the Wolf River. This is demonstrated by the absence of Lake Sturgeon above the Balsam Row Dam. However, survey results show definitively that the dam also acts as a barrier to the range expansion of aquatic invasive species, such as Common Carp, so that they are unable to colonize the upper reaches of the Wolf River beyond Balsam Row. Overall, species assemblage data show healthy indices of biotic integrity in all sample sites.

Six species were not observed during surveys above the Balsam Row Dam (Longnose Gar, Bowfin, Brook Silverside, Lake Chubsucker, Stonecat, and Blackchin Shiner), but these species may exist above the Balsam Row Dam within habitats that are suitable but were not successfully sampled

Game Fish and Panfish Summary

The fish assemblage in the Wolf River Pond, Balsam Row Pond and Wolf River includes panfish and predatory game fish species typical of small impoundments in other northern Wisconsin and other Midwest river systems. In terms of relative abundance, Northern Pike, Largemouth Bass and Smallmouth Bass were the most abundant predatory game fish species in the Study Area, while Bluegill and Black Crappie were the most abundant panfish species. Muskellunge and Walleye were present but in low densities. Other species present in varying abundance included: Pumpkinseed, Yellow Perch, Rock Bass and Black, Brown and Yellow Bullhead (see Table 7).

Generally, predatory game fish and panfish abundance metrics were at moderate to high levels in the Wolf River Pond but found at relatively lower levels in Balsam Row Pond when compared to statewide populations. Across all waters in the Study Area, predatory game fish and panfish size structure metrics for quality size fish were at moderate to high levels compared to other Wisconsin fish populations. Growth and relative weight metrics were at acceptable levels for most fish, and growth was generally

good for most species, but rates did vary from slow to fast, depending on the species and size (See Appendix N).

- Northern Pike were the most abundant predatory game fish sampled in the Wolf River Pond and Balsam Row Pond. Northern Pike populations appear to be at acceptable density levels for both abundance and size when compared to other waters in the state. In the Wolf River Pond, Northern Pike have access to an abundance of spawning areas both in the pond and connected waters of Shawano Lake and the Outlet Channel. In Balsam Row Pond, it appears spawning habitat is limited to a few areas of Wild Rice beds and some very small bays with emergent and submergent vegetation off the main river channel just upstream of the pond. Even with limited habitat, Northern Pike are of moderate quality size structure when compared to statewide indices.
- Largemouth Bass were found in much higher abundance in the Wolf River Pond versus the Balsam Row Pond. Optimal Largemouth Bass habitat consists of lacustrine habitat with extensive areas supporting submergent vegetation (Stuber et al. 1982). The Wolf River Pond, especially the lower areas, meets these habitat requirements. Backwater habitat is more prevalent and submergent and emergent aquatic vegetation is abundant. In addition, bass have access to the Outlet Channel and Shawano Lake which also have preferred habitat. Very few Largemouth Bass were sampled above the Balsam Row Dam which is not surprising given the relatively low amount of submergent vegetation, stained water, and lack of backwater areas.
- Panfish accounted for most of the catch in all waters of the Study Area. Bluegill was the dominant species and was found at relatively moderate to high abundance in the Wolf River Pond with moderate size structure, as compared to statewide populations. In the Balsam Row Pond, Bluegill were found at very low abundance, but size structure was very high with PSD₆ (78%) and RSD₇ metrics at the 95th percentile statewide. Black Crappie populations in Wolf River Pond were found in high abundance and exhibited above average size structure. Multiple age classes were represented, particularly age 3-5-year old which comprised the majority of the fishery. Interestingly, Black Crappie was at much lower density in the Balsam Row Pond. Habitat is likely the largest factor driving panfish abundance and size structure in both areas. Pumpkinseed were found at moderate to high abundance in Wolf River Pond but were found in low abundance in Balsam Row Pond. Yellow Perch were found in low numbers; However, Yellow Perch are difficult to sample using standard gear types and methods, so we cannot make definite conclusions about Yellow Perch abundance or size structure.
- Very few individual Muskellunge were captured during sampling efforts. In the Wolf River Pond, it is likely Muskellunge densities are higher than our survey would indicate. Periodic stocking of Muskellunge into the Wolf River Pond has occurred since 1977 and anecdotal angling reports indicate this fishery is very popular. It is also likely that Muskellunge migrate between the Wolf River Pond and Shawano Lake. In Shawano Lake, recent Department surveys indicate population density at a low level (0.17 per acre) with trophy size structure metrics above the

75th percentile statewide. Muskellunge were also sampled in the Balsam Row Pond and upstream river reaches. Past surveys have indicated a very low population density, and angler reports of Muskellunge in this area are rare. Stocking records indicate no stocking of Muskellunge in the Balsam Row Pond, and it is plausible that the current population is a remnant naturally reproducing population.

- During the Department's 2016 sampling efforts only 7 Walleye were captured between Shawano Paper Mill Dam and Balsam Row Dam. Above Balsam Row, only 1 Walleye was captured and sampled in 2016 during spring sampling. Additionally, Walleye may migrate from connected waters of Shawano Lake. Recent surveys in Shawano Lake indicate that the Walleye populations in Shawano Lake are at very low levels. For the past several years, Department staff have been working with the Shawano Chapter of Walleyes for Tomorrow which is stocking Walleye fry spawned from adults netted in Shawano Lake to re-build the Walleye population. Additionally, Walleye for Tomorrow has created rocky spawning habitat in Shawano Lake. Fish have been stocked into the Legend Lake complex, including Lake Sturgeon and Walleye. However, there is no indication that these species move out of Legend Lake and downstream into the Wolf River. In 2002, the dam structure that drained Legend Lake to the west through Keshena Creek to the Wolf River was plugged. All drainage from the Legend Lake chain now exits through Dam #3 at the East end into the Oconto River Watershed. Since that time, all water and aquatic organisms passage out of the Legend Lake chain has ceased.

Overall, predatory game fish and panfish species were similar between the Wolf River Pond and the Balsam Row Pond. Department surveys indicated higher abundance in the Wolf River Pond compared to the Balsam Row Pond. These differences may be from the different nature of the two impoundments, habitat differences, and fish having access to other water bodies. In the Wolf River Pond, backwater bay type habitat is more prevalent and aquatic plant abundance is at higher levels. In addition, Shawano Lake is a nearby connected water way that contains a high abundance of aquatic plant habitat which is preferred by Bluegill, Largemouth Bass and other panfish species.

Conversely, the Balsam Row Pond is a relatively narrow impoundment with minimal backwater areas and the habitat more closely resembles riverine type habitat. Movement studies conducted on Smallmouth and Walleye on the Wolf River System downstream of Shawano Paper Mill Dam indicate significant seasonal spawning and overwintering movements (Langhurst and Schoenike, 1990). While the Balsam Row Dam presents an impediment to migration, and habitat is very different between the two ponds, game fish populations are stable and appear to be sustaining themselves with natural reproduction in both impoundments (See Appendix N).

In the riverine portions of the Study Area (above Wolf River Pond to Balsam Row and above Balsam Row Pond to Keshena Falls), fish populations were also very similar. Smallmouth Bass was the dominant game fish in both river reaches. Length frequency distributions showed good representation of all sizes, indicating adequate natural reproduction. Relative abundance and size structure indicators were similar between both reaches and were above average compared to other northern Wisconsin rivers.

Lake Sturgeon Summary

The Winnebago System in east central Wisconsin is home to one of the largest naturally reproducing Lake Sturgeon populations in North America. Lake Sturgeon use both the Wolf and the Upper Fox River systems, including 2nd order tributaries, for spawning and nursery habitat and are able to migrate 111 miles upstream in high water years to the Park Lake Dam on the Upper Fox River and 125 miles upstream to the Shawano Paper Mill Dam on the Wolf River.

Lake Sturgeon are an important cultural resource to the Menominee Tribe as fish historically migrated upstream to utilize the rapids below Keshena Falls as spawning habitat. Construction of the Shawano Paper Mill Dam (1892) and Balsam Row Dam (1926) blocked upstream migration of Lake Sturgeon which prevented Lake Sturgeon from reaching a portion of their historic headwater spawning habitat, and also led to gradual extirpation of the species above Shawano Paper Mill Dam. The WDNR and MITW have worked collaboratively to restore Lake Sturgeon to the Wolf River since the early 1990s.

The 2016 survey methods for fish sampling did not specifically target Lake Sturgeon, and no Lake Sturgeon were captured using the methods employed during fisheries assessments. However, there have been extensive efforts to restore Lake Sturgeon within the Study Area (Appendix O).

Coordinated efforts to restore Lake Sturgeon to the Wolf River on Menominee Reservation by the Department, MITW, and USFWS began with implementation of the 1995 Menominee Reservation Lake Sturgeon Management Plan. The plan aimed to re-establish Lake Sturgeon populations within the MITW Reservation. The plan included an objective to restore a naturally reproducing population of Lake Sturgeon to the Wolf River from the Balsam Row Dam upstream to Keshena Falls. Capture and transfer of sub-adult and adult Lake Sturgeon has been the method used to achieve this objective. The first transfer cohort was moved upstream in 1995. A total of 148 adult fish were transferred upstream between 1995-2006, but efforts were stalled in 2007 following the discovery of VHS in the Winnebago system. A memorandum of understanding (MOU) between the Department and the MITW was established in 2011 (once research indicated that Lake Sturgeon were not susceptible to VHS) which increased capture and transfer efforts to a minimum of 100 adult fish per year. 645 Lake Sturgeon were transferred upstream between fall 2011 and spring 2016. Lake Sturgeon spawning has been observed below Keshena Falls each spring since 2012. (See Appendix O, Koenigs et.al, 2019). In addition, larval Lake Sturgeon were captured below Keshena Falls in 2013.

Most Lake Sturgeon transferred upstream between fall 2011 and spring 2014 were marked with acoustic transmitters to monitor movement following release. Telemetry data indicated that gravid Lake Sturgeon transferred pre-spawn in spring were the most likely to spawn above the Balsam Row Dam. Rates of downstream movement through the Balsam Row and Shawano Paper Mill Dams by Lake Sturgeon were quite high for all transfer periods. Mean retention times of Lake Sturgeon that remained above the Balsam Row Dam for greater than 1 year were 10-15%. Non-gravid Lake Sturgeon transferred outside of migration times (during the early fall period) exhibited the strongest likelihood to take up residence in the riverine sections of the Study Area (See Appendix O).

Aquatic Invasive Species (AIS)

AIS are a threat to Wisconsin lakes and rivers and can have impacts to ecosystem, human health, recreation and other natural resources uses, and the economy. Ecological impacts of introduced invasive species can range in severity depending on differing ecosystem variables, with specific impacts difficult to predict. Invasive species are problematic because their population can grow to nuisance levels negatively affecting the environment.

The Department developed the Wisconsin Aquatic Invasive Species Management Plan (WDNR 2019). This plan identifies strategies to prevent, control and manage AIS. The plan also identifies potential pathways for the spread of AIS.

Wisconsin Statute § 23.22(2)(b)6. directs the Department to promulgate rules to identify, classify and control invasive species. The Department's invasive species rules (Wis. Adm. Code Ch. NR 40) makes it illegal for any person to possess, transport, transfer, or introduce certain invasive species in Wisconsin without a permit. Within waters of the state, the issuance of permits is generally limited to research and public display purposes. 23.22(3)(c). The regulations are aimed at preventing new AIS from spreading and enabling quick action to control or eradicate occurrences. These regulations apply regardless of the level of threat the species may impose, or regardless of what other management priorities might exist. These rules supersede other management objectives and AIS prevention and control can constrain management options for other species. A list of regulated species as well as detailed information on those species can be found at <https://dnr.wi.gov/topic/invasives/classification.html>.

AIS data collection occurred in both the Wolf River Pond and Balsam Row Pond. Data was not collected within the riverine sections of the Study Area. Data collection ended at the northern end of the Shawano County line.

AIS detected in Balsam Row Pond consisted of Eurasian Watermilfoil, Rusty Crayfish, Chinese Mystery Snail, Narrowleaf Cattail, Purple Loosestrife, and Aquatic Forget-Me-Not. Zebra mussels veligers have been confirmed in the Wolf River Pond since 2007, and as recently as 2013. Plankton samples collected in 2016 to look for Zebra mussel veligers were negative. Sediment samples to look for Spiny Waterfleas were negative (See Appendix K).

AIS detected in Wolf River Pond consisted of Common Carp (captured in fisheries surveys), Eurasian watermilfoil, Chinese Mystery Snail, Narrowleaf Cattail, Purple Loosestrife, Aquatic Forget-Me-Not, Banded Mystery Snail, & Curly-Leaf Pondweed. Plankton samples collected in 2016 sampling for Zebra mussels and sediment samples collected to look for Spiny Waterfleas were negative. However, Zebra Mussels and Rusty Crayfish have been previously reported (and verified) in the Wolf River Pond but none were observed during the survey. The Wolf River Pond is the farthest upstream sample location where the Department has verified the presence of Zebra mussels.

- Common Carp were found in the Wolf River Pond but have not been observed above the Balsam Row Dam. Additionally, Carp have been observed below the Shawano Paper Mill Dam, but not above. During the 2014 surveys, Common Carp had a CPUE of 4.1 per mile in Wolf River Pond,

ranking it in the 75th percentile statewide, meaning that CPUE is higher than 75% of the state's waters. As early as the 1870s, Common Carp were stocked in Wisconsin waters as a potential food item. Unfortunately, they are known to be a destructive aquatic invasive species, uprooting aquatic plants, disturbing sediments, and negatively impacting water quality. Common Carp also compete with other fish species for habitat, forage, and spawning areas with the potential to cause shifts in the fish community (Becker, 1983). They have been documented in Shawano Lake since at least 1968 (Andrews and Threinen 1968). The Department does not actively manage to reduce Common Carp in Shawano Lake or the Wolf River. They are firmly established in this system and the complexities of the system does not allow for eradication. Once established in a complex system, it is difficult if not impossible to eradicate Common Carp. The Balsam Row Dam currently prevents the natural migration of Carp to upstream reaches of the Wolf River.

- Purple Loosestrife is a major concern to the Wolf River's native plant community. It has invaded many areas of the Wolf River and has overwhelmed some native Wild Rice beds. In the past 12 years, local organizations have spread and increased numbers of Galurecella beetles that feed on and help control Purple Loosestrife. The local organizations, including MTE, MITW, county conservation Departments, Cooperative Invasive Species Management Area (CISMA) and TIP work together for the education and eradication of invasive species.
- Zebra Mussels are known to be present in the Wolf River Pond but not upstream of Balsam Row Dam. Zebra mussels have caused great ecological and economical harm in locations where they have invaded. Zebra mussels feed by drawing water through their bodies and can reach very high densities. They can have major ecological impacts and cause widespread changes to the waterbodies they invade including altering food webs and algal communities promoting blue green bacteria over other species. Zebra mussels can also substantially impact native mussel populations by attaching to the shells of native species and smothering them. Zebra mussels also attach to water intake structures, dams and other water structures impeding operations and causing deterioration resulting in substantial increases in management cost for these types of structures (<https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5>).

Fish Health

Fish, just like humans and other animals, contract pathogens and parasites and suffer from disease. Fish can contract diseases from viral, bacterial, fungal and parasitic infections and these can be a significant cause of mortality within populations.

Viral Hemorrhagic Septicemia virus (VHS), for instance, is a deadly fish virus that poses a serious threat to Wisconsin's aquatic communities. The VHS virus is not native to the Great Lakes region. VHS was first detected in inland waters of Wisconsin in 2007 in fish from the Winnebago and Lake Michigan systems. Major fish kills confirmed to be caused by VHS occurred in the Winnebago system as recent as in spring of 2018. Thus, there are VHS positive waters connected to the Wolf River Study Area, and the virus has been identified in fish species (including Freshwater Drum, Largemouth Bass, Yellow Perch, Bluegill, and Black Crappie) captured downstream of the Shawano Paper Mill Dam. Currently, no testing has been done above the Shawano Paper Mill Dam; as such, there have been no confirmed cases of VHS in this

region of the Wolf River system. Though VHS is of significant concern, it is important to consider that there are numerous pathogens capable of causing disease in fish. These pathogens may or may not be present within the Wolf River. Very limited examples of potential fish pathogens are those listed by DATCP and the Great Lakes Fish Health Commission, including viral agents such as Infectious Hematopoietic Necrosis virus (IHNV) and Infectious Pancreatic Necrosis virus (IPNV), as well as bacterial agents such *Aeromonas salmonicida salmonicida* (associated with Furunculosis) and *Renibacterium salmoninarum* (associated with Bacterial Kidney Disease). Though these pathogens have been well described in fish health literature and only potentially exist within the Wolf River, other pathogens constitute emerging diseases that are actively being researched within the waterbody, notably the newly identified Acipenserid Herpesvirus 1.

DATCP regulates the movement of fish species which are susceptible to the disease. A list of fish listed as susceptible can be found at:

https://www.aphis.usda.gov/animal_health/downloads/animal_diseases/Species_Previously_Regulated_by_APHIS_for_VHS_2014.pdf. These regulations are found in Wis. Admin. Code ATCP § 10.655(1) of the Wisconsin Administrative Code. These regulations apply regardless of the level of threat the species may impose, or regardless of what other management priorities might exist. The Department also instituted a series of policies aimed at preventing the spread of VHS. For example, Department Manual Code # 9183.1 Boat, Gear and Equipment Decontamination and Disinfection Protocol, helps protect against pathogen transmission between waterbodies by requiring all Department employees, agents and service providers, and some permittees to take steps to decontaminate boats, gear and equipment.

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Acronyms

- Pound
AIS – Aquatic Invasive Species
BIA – Bureau of Indian Affairs
C - Celsius
Cfs – Cubic feet per second
CPE – catch per unit effort
CTH – County Highway
DATCP – Department of Agriculture, Trade and Consumer Protection
DELT – Deformities, Eroded Fins, Lesions and Tumors
DO – Dissolved oxygen
DOI – U.S. Department of Interior
DNR – Department of Natural Resources
D/S = Downstream
EA – Environmental Assessment
ECPA – Electronic Consumer Protection Act
EIS – Environmental Impact Statement
EPT – Ephemeroptera, Plecoptera, Tricoptera
EWM – Eurasian Watermilfoil
F - Fahrenheit
FE – fall electrofishing
FEMA – Federal Emergency Management Agency
FERC – Federal Energy Regulatory Commission
FQI – Floristic quality index
Ft - feet
FPA - Federal Power Act
FWS - US Fish and Wildlife Service
GIS – Geographic Information System
H₂O - water
HBI – Hilsenhoff Biotic Index
HIBI – Habitat Index of Biotic Integrity
IBI – Index of Biotic Integrity
kg - killogram
kV - kilovolt
kW - kilowatt
KWh – kilowatt per hour
lb's - pounds
M - Meter
M² – Meter square
MG/L – milligrams per liter
mi - mile

MIBI – Macroinvertebrate Index of Biotic Integrity
MITW – Menominee Tribe of Wisconsin
Mm - millimeter
MOU – Memorandum of Understanding
Mph – Miles per hour
NAD – North American Datum
NGVD – National Geodetic Vertical Datum
oz - ounce
PA - Programmatic Agreement
PSD – Proportional Stock Density
RA – River Alliance
RSD – Relative Stock Density
SA – Settlement Agreement
SE – spring electrofishing
SFT – Sturgeon for Tomorrow
SHPO – State Historical Preservation Office
SN – spring netting
STH – State Highway
TMDL – Total Maximum Daily Limit
TSS – Total Suspended Solids
Unt – Unnamed Tributary
UNTWRP – Un-named Tributary to Wolf River Pond
U/P - Upstream
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
VHS – Viral Hemorrhagic Septicemia virus
WBIC – Waterbody Identifier Code
WDNR – Wisconsin Department of Natural Resources
WPUE – weight per unit effort
Wr – relative weight
WT – weight

Appendix A: Balsam Row Original FERC License (1997)

(Original 1997 License with all the citations is located at www.ferc.gov)

UNITED STATES OF AMERICA FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Elizabeth Anne Moler, Chair;

Vicky A. Bailey, James J. Hoecker, and Donald F. Santa, Jr.

Wisconsin Power and Light Company Project No. 710 and Docket No. D196-4-000

ORDER ISSUING NEW LICENSE (Issued May 16, 1997)

Wisconsin Power and Light Company (Wisconsin Power) filed an application, pursuant to Part I of the Federal Power Act (FPA), for a new license authorizing the continued operation and maintenance of the 700-kilowatt(kW) Shawano Hydroelectric Project No. 710, located on the Wolf River in Shawano County, Wisconsin, and in part within the Menominee Indian Reservation (Menominee Reservation). Wisconsin Power, an electric utility, would continue to use the electricity generated by the project for its customers. It proposes no new capacity.

The original license for the Shawano Project was issued on July 20, 1927 and expired on July 19, 1977. An annual license was issued on July 15, 1977, and since then project operations have continued pursuant to annual licenses pending the disposition of Wisconsin Power's application for a new license. For the reasons discussed below, we issue a new license to Wisconsin Power.

BACKGROUND: Wisconsin Power filed its relicense application for the Shawano Project on November 8, 1976 and amended it on June 30, 1992. Notice of the amended application was issued on August 28, 1992. Timely motions to intervene were filed by the Wisconsin Department of Natural Resources (Wisconsin DNR), the U.S. Department of the Interior (DOI/Interior), and the City of Shawano.

On June 11, 1996, the Menominee Indian Tribe (Menominee Tribe) filed a motion requesting clarification of its status and, if it was not already a party, that it be permitted to intervene. While the Commission has received no specific motion requesting intervention status for the Menominee Tribe, the Tribe clearly has an interest in this proceeding, in which it has fully participated. We will therefore grant it intervention.

An Environmental Assessment(EA) for this project was issued February 23, 1993. A Safety and Design Assessment was also prepared and is available in the Commission's public file associated with this project. All comments received from interested agencies and individuals have been fully considered in determining whether, or under what conditions, to issue this license.

FPA Section 7(a) was amended by Section 2 of the Electric Consumers Protection Act of 1986 (ECPA) to clarify that the municipal preference does not apply to Section 15 relicensing proceedings, and on March 2, 1987, the City withdrew its competing application.

In November 1988, Commission staff asked Wisconsin Power to update its 1976 license application to conform to the commission's post-ECPA regulations. Wisconsin Power filed the additional information on June 30, 1992. Interior filing of October 27, 1992; *Wisconsin DNR filing* of September 16, 1992. The City of Shawano was granted intervention on September 20, 1978; it has not participated in the proceeding since 1987.

PROJECT DESCRIPTION: The existing Shawano Project consists of (from left to right looking downstream): a 155-foot-long and 12.5-foot-high earth dam section with crest elevation at 823.5 feet; a reservoir with storage capacity of 2,860 acre-feet, extending about four miles upstream and with a maximum depth of 15 feet; a 41-foot-long by 68-foot-wide powerhouse section with a capacity of 700 kW; a 115-foot-long reinforced-concrete gated spillway section with six 14-foot-wide by 14-foot-high electrically operated Tainter gates, and an 8-foot-wide by 73-foot-long rubbish sluiceway controlled with an 8-foot-8-inch by 19-foot-7-inch sluice gate; a 143-foot-long and 18-foot-high earth dam section with crest elevation at 823.5; and appurtenant electrical and mechanical facilities.

Because the powerhouse is integrated as a part of the dam and discharges directly into the river, there is no bypass reach. The project produces approximately 3,810,000 kilowatt hours of electricity annually.

PRELIMINARY ISSUES: A. Jurisdiction: On February 12, 1996, Wisconsin Power filed a motion for investigation of the jurisdictional status of the Shawano Project, arguing that it does not meet any of the criteria for which licensing is required under Section 23(b) (1) of the FPA. On February 23, 1996, Interior filed an answer maintaining that a license is required, because a part of the project occupies the Menominee Reservation.

Pursuant to Section 23(b) (1) of the FPA, a license is required for a hydroelectric project if it: (1) is located on navigable waters of the United States; (2) occupies lands or reservations of the United States; (3) uses the surplus water or water power from a government dam; or (4) is located on a non-navigable Commerce Clause stream, affects the interests of interstate or foreign commerce, and has undergone construction or major modification after August 26, 1935. A project need only meet one of these criteria for a license to be required. A part of the Shawano Project's reservoir occupies a portion of the Menominee Reservation, which is held in the name of the United States in trust for the Menominee Tribe. Thus, the project occupies lands of the United States.

Wisconsin Power concedes that the project reservoir is located in part on the reservation, but asserts, without elaboration, that the reservoir is not a project work within the meaning of Section 3(11) of the FPA and therefore is not a part of the project for jurisdictional purposes.

Section 3(11) defines a project as including reservoirs, the use and occupancy of which are necessary or appropriate in the maintenance and operation of such project. The reservoir provides hydrostatic head for the production of hydropower at the project. Thus, the reservoir comes squarely within the definition set forth in Section 3(11). This is why Article 2.C. of Wisconsin Power's original license for the Shawano Project included the reservoir among the project works.

In addition, the Wolf River at the project site is a navigable water of the United States. A Commission staff report establishes that for over half a century the Wolf River was extensively used to drive billions of logs to mills on the Fox River, whence timber was transported via the Fox and Wisconsin Rivers to markets in the Great Lakes and Mississippi River basins.

Background: Section 4(e) of the FPA requires that Commission licenses for projects located on United States reservations include all conditions that the Secretary of the Department under whose supervision the reservation falls shall deem necessary for the adequate protection and utilization of such reservation. As noted above, a portion of the Shawano Project is located on the Menominee Reservation, which is under the supervision of the Department of the Interior.

The notice of application issued August 18, 1992, in this proceeding provided for, mandatory conditions pursuant to FPA Section 4(e) to be filed by October 27, 1992. Conditions filed after the deadline (but before the license order) would be considered under the public interest standard of FPA Section 10(a) (1). Interior did not file Section 4(e) conditions by the deadline. Some 17 months later, on March 28, 1994, it filed a letter stating that it had only recently discovered that a portion of the project reservoir is located on the Menominee Indian Reservation. In light of this, Interior asserted its right to submit Section 4(e) conditions after the 1992 deadline and stated that it needed a minimum of 18 months to do so.

By letter dated June 24, 1994, the Commission staff gave Interior another 90 days (until September 22, 1994) to submit Section 4(e) conditions. By filing of September 22, 1994, Interior reiterated its position that it needed 18 months to develop conditions. As part of its demand for more time, Interior asserted that the Commission Staff's Environmental Assessment (EA) for the project did not contain a comprehensive evaluation of project impacts on the reservation. Interior also argued that the Commission lacks the authority to set a deadline on Section 4(e) condition submittals, and that the assertion of such authority in this case contravenes the Government's trust responsibility to protect the lands and resources of Indian Tribes.

B. Discussion: Interior states that it did not timely file Section 4(e) conditions because it did not discover that a portion of the Shawano Project reservoir is located on the Menominee Reservation until a December 1993 U.S. Army Corps of Engineers report "established" that the project extends into the reservation.

The Shawano Project reservoir has in fact always occupied part of the Menominee Indian Reservation. The Federal Power Commission Annual Report of 1928 reports issuance of the original Shawano license for a project that would back water up to Keshena Falls within the Menominee Reservation, and states that about 60 percent of the Study Area would occupy Indian lands. Wisconsin Power's 1976 relicense application shows the reservoir (and the project boundary) as including Reservation land.

In as much as Interior was served with the license application amendment in May 1989 and filed comments with respect to the project reservoir's effects on the Reservation on October 29, 1992, 17

months before it states it learned of the reservoir's partial location on the Reservation, it is difficult to understand its asserted lack of this knowledge, and therefore difficult to see how it had a valid basis for obtaining additional time to supply Section 4(e) conditions.

Be that as it may, even if we assume that Interior was first aware of the project's location on the Menominee Reservation as of December 1993, Interior has failed to justify its continued failure to submit Section 4(e) conditions. As noted, the Commission's regulations provide for Section 4(e) conditions to be filed by 60 days after issuance of public notice that the license application is ready for environmental analysis. Since the Section 4(e) conditions are to precede, and provide information for, the EA, Interior cannot argue that its formulation of Section 4(e) conditions was hindered by what it perceives is an inadequate EA.

The regulations provide further that, if agency proceedings to determine license conditions are not completed by the due date, the agency must file by that date either a statement that no conditions will be submitted, or preliminary conditions and a schedule showing the status of agency proceedings and when the conditions are expected to become final. Interior's September 1994 letter stated that it needed at least 18 months until the end of September 1995 -- to develop the conditions. That date passed 19 months ago. By filing of August 7, 1995, Interior revised this schedule, stating its intention to submit Section 4(e) conditions "in time for inclusion within [the Commission staff's] environmental analysis and subsequent drafting of the EIS" that Interior argues is required.

Interior's assertion that the Commission lacks authority to establish deadlines for the submittal of mandatory conditions was addressed in the rulemaking which established those deadlines and will not be repeated here. As we noted therein, deadlines are necessary for the proper conduct of virtually any type of proceeding, and serve to ensure that parties cannot, through undue delay in fulfilling their roles, unilaterally block action on pending matters. However, we emphasized, and this case certainly illustrates, that we would be receptive and flexible with regard to a resource agency's demonstrated need for more time to prepare its submittals.

It is, however, now over three years since Interior's March 28, 1994 letter asking that the clock be restarted for its Section 4(e) submittals. At this point, we conclude the time has come to proceed with issuance of a new license for the Shawano Project, which has been operating under annual license for nearly 20 years, and to delay no further the imposition of new environmentally beneficial conditions on that operation.

Interior also argues that imposing a deadline for submittal of Section 4(e) conditions for tribal reservations contravenes the Commission's trust responsibility to Indian tribes to always act in their interests. We recognize this responsibility, which we exercise in the context of the FPA and our implementing regulations. We do not, however, see how it is in the Tribe's interest to delay any further this 20-year-old relicense proceeding, particularly since issuance of a new license does not preclude Interior, or the Tribe itself, from filing requests for any needed modifications to the project pursuant to the Commission's reserved authority.

C. Motion to Compel Preparation of an EIS: On August 7, 1995, Interior and the Menominee Tribe filed a motion to compel preparation of an environmental impact statement (EIS), on the ground that the EA failed to consider the project's impacts on the Menominee Reservation. The movants cite the Commission's obligation under FPA Section 4(e) to ensure that any project occupying a federal reservation will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. Interior argues that the EA's failure to recognize the Menominee Reservation as federal land meant that "information relevant to the environmental concerns and bearing on the proposed action was overlooked."

Despite the EA's failure to recognize that the Menominee Reservation was once more federal, the EA clearly recognized that a portion of the project is located on the Reservation. It certainly knew and addressed the issues of concern to the Tribe, notably restoration of the Lake Sturgeon fishery, the problem of frazil ice formation, and protection of cultural resources (all discussed below). This is not surprising, since the Tribe (as well as Interior's Fish and Wildlife Service) was consulted extensively during the three-year consultation and study process that preceded Wisconsin Power's submittal of its six-volume 1992 application amendment. The Tribe and Interior were among the parties to whom Wisconsin Power in May 1989 submitted its updated application for prefiling consultation, and they responded in June and October, respectively, of that year. In addition, the Tribe and Interior attended several meetings prior to public notice of the application amendment,

The Treaty with the Menominee Indians of May 12, 1854, established a reservation for the Tribe on the Wolf River in Wisconsin, and the original license for the Shawano Project recognized that most of the Shawano Project was to occupy the Menominee Indian Reservation, held and administered by the United States in trust for the Menominee's.

However, under the Menominee Termination Act of 1954, Pub. L. No. 83-399, 68 Stat. 250 (June 17, 1954), Congress provided that federal supervision over the Menominee Tribe would end, and that state law would then apply to the Tribe and its members. Section 8 of the Termination Act directed the Secretary of the Interior to transfer to the Tribe the title to all property, real and personal, held in trust by the United States for the Tribe. In a proclamation made pursuant to the Termination Act, 26 Fed. Reg. 3726, Interior transferred title to the reservation lands and ended supervision effective as of April 30, 1961.

In 1973, Congress passed the Menominee Restoration Act, Pub. L. No. 93-197, 87 Stat. 770 (December 22, 1973), which repealed the Termination Act, reinstated all rights and privileges of the Tribe under federal treaties and statutes, and reestablished the Menominee Reservation. The Menominee Tribe commented and participated in discussions concerning a programmatic agreement to protect cultural resources.

Finally, both Interior and the Tribe participated in 10(j) negotiations, including meetings on April 29 and May 24, 1993, concerning the fish and wildlife agencies' Section 10(j) recommendations (discussed below). At these meetings, the parties also specifically discussed the Tribe's concerns related to annual charges, passage of Lake Sturgeon, flooding, and historic preservation. In sum, the EA reflects staff's

awareness of and attention to all the issues of concern to Interior and the Tribe, and properly serves as a part of the record of this proceeding on which to make a determination regarding the project's consistency with the Reservation, which we do below.

Interior also argues that an EIS is necessary because, allegedly, the EA failed to examine the cumulative impacts of the Shawano Project together with the Little Rapids Corporation's Shawano Paper Mill Project No. 8015, located 5.3 miles downstream from the Shawano Dam, 32/ on the Wolf River fishery, notably Lake Sturgeon, a historically important resource for the Menominee Tribe.

Although there is a spring spawning run of Lake Sturgeon up to the Paper Mill Project, that project, which is located approximately 5.3 miles downstream of the Shawano Project, currently *is* an absolute barrier to the upstream migration of Lake Sturgeon, and the exemptee has no current plans for, nor did any agency reserve authority to require, the installation of fish passage facilities at the project. In light of this, the EA finds that the Shawano Project does not contribute to an adverse effect on the upstream migration of Lake Sturgeon. As the EA also notes, if fish passage is accomplished at the downstream Paper Mill Project, the license reserves Interior's authority under FPA Section 18 to prescribe fishways at the Shawano Project.

WATER QUALITY CERTIFICATION: Under Section 401(a) (1) of the Clean Water Act, the Commission may not issue a license for a hydroelectric project unless the state certifying agency has issued water quality certification for the project or has waived certification by failing to act on a request for certification within a reasonable time, not to exceed one year.

On November 8, 1976, Wisconsin Power applied to Wisconsin DNR for water quality certification for its relicense proposal. By letter dated April 20, 1979, Wisconsin DNR waived certification. In 1981, as part of the process of updating its license application to conform with ECPA, Wisconsin Power filed a second request for water quality certification, and by letter dated October 30, 1991, the Wisconsin DNR again waived certification.

SECTION 18 OF THE FPA: Section 18 of the FPA states that the Commission shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of Commerce and the Interior may prescribe. Interior has requested that the Commission reserve its fishway prescription authority. Article 407 reserves that authority.

RECOMMENDATIONS OF FEDERAL AND STATE FISH AND WILDLIFE AGENCIES PURSUANT TO SECTION 10(j) OF THE FPA: Section 10(j) of the FPA requires the Commission, when issuing a license, to include license conditions, based on recommendations of federal and state fish and wildlife agencies submitted pursuant to the Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661 for the protection of, mitigation of adverse impacts to, and enhancement of fish and wildlife resources, unless such conditions would conflict with the FPA or other applicable law.

If the Commission believes that any such recommendation may be inconsistent with the purposes and requirements of Part I of the FPA or other applicable law, Section 10(j) (2) requires the Commission and

the agencies to attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agencies. If the Commission then does not adopt a recommendation, it must explain how the recommendation is inconsistent with applicable law and how the conditions selected by the Commission adequately and equitably protect, mitigate damages to, and enhance fish and wildlife.

A number of recommendations were filed by Interior and by Wisconsin DNR pursuant to Section 10(j). The license contains conditions consistent with Interior's and Wisconsin DNR's recommendations that Wisconsin Power: (1) operate the project in an instantaneous run-of-river mode, maintaining a surface reservoir elevation of 818.0 feet plus or minus 0.3 feet National Geodetic Vertical Datum (Article 402); (2) monitor the instantaneous run-of-river operation (Article 403); (3) discontinue the sluicing of logs and debris through the dam (Article 404); (4) implement a streamflow gaging plan (Article 403); (5) pass river inflow through the project in the event of project shut-down (Article 403); (6) develop and implement a plan to maintain dissolved oxygen levels at five milligrams per liter (mg/l) or greater (Article 405); (7) monitor purple loosestrife in project waters (Article 409); and (8) develop a plan to preserve Bald Eagle nesting sites (Article 410).

One recommendation requires further discussion. To mitigate for fish entrainment and turbine mortality, Interior and Wisconsin DNR recommended that Wisconsin Power provide for downstream fish protection facilities, such as angled trashracks or fish screens. The EA estimated that the levelized annual cost of installing a new trashrack at the project intake would be over \$19,000. The EA also concluded, based on the results of Wisconsin Power's entrainment study, that the estimated entrainment and turbine mortality rate would be only about 2.2 percent, i.e., some 1,000 fish annually. Because the costs for fish protection noted above would have a significant adverse effect on project economics, while the benefit to fishery resources resulting from imposition of the recommendation would be fairly small, a preliminary determination was made that the recommended downstream fish protection plan is inconsistent with the purposes and requirements of Part I of the FPA.

In accordance with the requirements of Section 10(j) (2), staff notified Interior and the Wisconsin DNR of its preliminary inconsistency determination regarding this recommendation. After receiving the agencies' responsive comments, staff held a telephone conference with Interior and Wisconsin DNR, and a meeting in Keshena, Wisconsin, to attempt to resolve the conflict. As a result of these meetings, the agencies agreed that, in lieu of their initial recommendation, they would accept a requirement that Wisconsin Power provide a yearly payment of \$4,100, adjusted annually, to a special fund set up and administered by Wisconsin DNR to finance resource-based fishery enhancement activities in the Study Area, or, if cost-effective measures are developed, facilities to reduce turbine-induced fish mortality or injury.

We see no need to disturb the agreement reached in this proceeding between the Commission staff and the fish and wildlife agencies in the context of the requirements of FPA Section 10(j). However, in as much as we must retain regulatory authority over actions that we require of our licensees, we will provide, as we have in other cases that the continuation of funding be subject to Commission approval of the use of such funds (Article 408).

RECOMMENDATIONS UNDER SECTION 10(a) OF THE FPA: As noted above, we consider pursuant to FPA Section 10(a) those recommendations that are outside the scope of Section 10(j) Interior and Wisconsin DNR recommend that Wisconsin Power conduct a fishery assessment (involving the monitoring of DO and surveys of the fishery) of the river 1/2 mile downstream of the dam, and additional surveys at ten-year intervals thereafter. Wisconsin DNR states that periodic monitoring of DO levels is necessary in order to develop prompt remedial action for DO level violations, and that periodic surveys are necessary to assess the quality of the fishery, so that it can implement appropriate fish management practices to maintain a quality fishery for the sport fishing public.

As noted above in our Section 10(j) discussion, the water quality monitoring plan required by license Article 405 already includes DO as a subject, and the agencies are to be consulted regarding the monitoring plan and results. Consequently, as pertains to DO levels, this recommendation is redundant and is not adopted. Furthermore, the proposed periodic surveys would entail costs to the licensee but would not provide any benefit to the environment or serve any licensing needs.

Noting that two state threatened mussel species, the Salamander and the Slippershell mussels, have been found approximately 328 feet below the project dam, Wisconsin DNR recommends that a survey of aquatic insects and mussels be required in the reach of the Wolf River extending about 3.5 miles downstream from the project and states that if significant rare species are found, Wisconsin DNR may request more detailed studies to develop management recommendations for these species. However, Wisconsin Power has already performed an aquatic macro- invertebrate survey at sites both upstream and downstream from the project. Its survey found, upstream, four species of aquatic insects listed by the state as imperiled, rare, or uncommon, and found downstream, three species listed by the state as rare or uncommon and species with uncertain status. No federally listed threatened or endangered species were found. Wisconsin DNR, which reviewed the survey, has not recommended any measures related to the state-listed species in this proceeding, and the run-of-river mode of operation required by Article 402 provides stable environmental conditions approximating those to which fish and other aquatic life are adapted. Wisconsin DNR has made no showing of the need for further surveys.

Wisconsin DNR requests a license article requiring Wisconsin Power to perform a dam-break analysis which meets the State's standards. We will not adopt the Wisconsin DNR's recommendation. Wisconsin Power is subject to the FPA and to federal dam safety standards. Pursuant to these federal standards, a dam-break analysis has already been performed, reviewed, and found acceptable.

Interior and Wisconsin DNR also recommended that Wisconsin Power be required to improve the boat launch facility on the west side of the flowage and to complete the canoe portage within two years. We will so require (Article 412).

ADDITIONAL INTERVENOR ISSUES:

Sturgeon: The Menominee Tribe states that Lake Sturgeon historically has been an important food resource for the Tribe but is no longer found within the Menominee Reservation because the Shawano Project's dam and the downstream Paper Mill Project No. 8015, described earlier, prevent the sturgeon's passage upstream. It argues that the project, in interfering with upstream passage of the sturgeon, interferes with the purpose for which the Menominee Reservation was created, and in the

alternative, it requests the imposition of license conditions (1) reserving to the Commission authority to require fishways and (2) requiring Wisconsin Power to negotiate with the Tribe an annual fee for the past and current loss to its fishery resource, including Lake Sturgeon.

As noted, fish passage at Shawano Dam will become relevant to the Tribe's fishery only when fish passage is obtained at the downstream Paper Mill Project, which is a complete barrier to upstream migration of Lake Sturgeon. However, the license reserves the Commission's authority to require at the Shawano Project such fishways as Interior may prescribe, so that once Lake Sturgeon can reach the project, upstream passage past it can be achieved. We will not require the licensee to negotiate a fee for the Menominee Tribe's "loss" of the sturgeon; it is well established that the Commission has no authority to adjudicate claims for, or require payment of, damages.

Flooding: The Menominee Tribe argues that the Shawano Project, by creating reduced flow, slack water, increased sedimentation, siltation, and widening of the river above the project dam, contributes to the formation of frazil ice, which in turn results in occasional flooding in the upstream Village of Keshena, located on the Reservation, and therefore is the cause of that flooding. The Tribe submitted a flood control study prepared by the Corps of Engineers in support of its contention.

Frazil ice is a type of ice which forms underwater when temperatures are very cold and water velocity is sufficient to prevent the formation of an ice sheet on the surface of the water. So long as the water velocity remains above a threshold level, the frazil remains entrained in the water column and will move downstream without rising to the top. However, where the water velocity decreases and becomes slackwater, the frazil *ice* will rise to the surface and adhere to the ice cover there or to whatever else is in its path, creating, in essence, an ice dam.

As discussed in the EA, frazil ice is a natural condition which occurs regardless of the presence or absence of hydroelectric projects. The rate of heat loss for reservoirs typically is lower than for the river environment. An ice cover is more likely to form in this slow water environment. Thus, reservoirs have less tendency to form frazil ice than the riverine environment.

The Corps report submitted by the Menominee Tribe supports this view, stating that the frazil ice forms above Keshena and below Keshena Falls, in the Wolf River above the Shawano Project's impoundment.

However, while the Shawano Project does not cause the formation of frazil ice, the Corps study concludes that it probably exacerbates any resulting flooding. The Corps report finds that the Keshena Falls Dam, which had been located above Keshena, held back most of the frazil ice generated upstream of Keshena Falls until the dam failed in 1972. Without the Keshena Falls Dam to block it, the frazil ice now travels downstream until it reaches the backwater of the Shawano Project's dam, where it builds up, raising the water level upstream.

Although the Corps considers modification of project operations as a possible way to reduce flooding, it does not recommend any changes at the Shawano Project, stating that it would only move the *ice* jam initiation point further downstream, merely delaying any flooding by a day or two. The Corps notes that another way to reduce flooding is to reduce the volume of frazil *ice* generated and discusses a number

of *ice* control options. The Corps concludes that the most suitable *ice* control would be the reconstruction of the Keshena Falls Dam and recommends additional studies and surveys to determine the optimum ice control method.

Since it does not appear that any alteration of the Shawano Project would, by itself, be an effective solution to the flooding problem, the license requires Wisconsin Power to consult with the Menominee Tribe and the Corps concerning any further studies the Corps conducts and retains authority to require Wisconsin Power to take action to alleviate the flooding, if a feasible solution is found.

Cultural Resources: On December 26, 1996, Interior filed a motion requesting reopening of the Programmatic Agreement developed in this proceeding pursuant to the requirements of Section 106 of the National Historic Preservation Act. Interior maintains, without citation, that it should have been included in the preparation of the Agreement but was not included because the Commission was under the mistaken impression that there was no federal interest in the tribal lands within the project boundaries.

While the regulations adopted by the Advisory Council on Historic Preservation (Advisory Council) to implement Section 106 specifically require the participation of Indian Tribes in the consultation leading to the development of an Agreement, they do not appear to set out any specific requirement for Interior's participation in such preparation where Indian land is involved. Furthermore, Interior's argument that we somehow failed in consultation on cultural resources because we initially failed to recognize the Indian land as a reservation is groundless.

The Menominee Tribe was invited to be a consulting party, was fully included in such consultation, and concurred *in* the Agreement on October 5, 1993.

Dam Removal: The Menominee Tribe has opposed relicense of the project, arguing that the project's dam should be removed, on the basis that the project is a barrier to the historical upstream passage of Lake Sturgeon, and causes flooding of tribal lands. The above discussions on these matters demonstrate that these bases for dam removal are unpersuasive. Nevertheless, we have examined the option of denying the new license and requiring removal of the project dam.

Project retirement with partial removal of the dam would have a number of effects on environmental values. The natural flow regime of the Wolf River would be restored, and downstream flow patterns would be similar to the flows under the proposed run-of-river operating mode, but without the fluctuating water levels that result from debris sluicing activities. The surface waters of the Wolf River are well oxygenated, and the additional turbulence created by the restored free-flowing segment of the river probably would result in dissolved oxygen levels maintained at or above the State of Wisconsin's water quality standards.

The Shawano-affected reach would change from a wide channel with fine substrates and relatively slow velocities to a somewhat steeper gradient channel with coarser substrates and more riffle and pool habitats. This would likely cause a shift in habitat characteristics, resulting in a shift in fish species composition in the area.

Opening the spillway gate and drawing down the reservoir could also result in the conversion of palustrine impounded bottom to riverine unconsolidated bottom and the loss of permanently or seasonally flooded emergent wetlands. The sediment accumulation behind Shawano Dam has created a combination of shallow flats, braided stream channels, and wetlands.

Although with dam removal, the project reservoir's accumulated sediments would move downstream, this is not expected to create any significant wetlands downstream, nor is it expected that wetland formation along the channel upstream from the Shawano Dam will replace the wetland complex within the boundary of the original impoundment. Thus, no new wetlands would be created to replace those lost. This could, among other things, degrade existing Bald Eagle habitat in and around the project area by eliminating resting, feeding, breeding, and nesting habitat, as well as a potentially important forage base.

The analysis of project economics also militates against project retirement and dam removal. As is described under Comprehensive Development, below, the EA evaluated two alternatives: the project as proposed by Wisconsin Power and the project as proposed by Wisconsin Power with operational, mitigation, and enhancement measures based on recommendations of the agencies and Commission staff. If the project is retired, the dam removed, and the site restored, the total cost would be about \$2,819,000. The equivalent annual cost of alternative power plus the cost of complete dam removal would be about \$466,860, or about 117.3 mills/kWh. This alternative would cost about \$297,250 more annually, or about 78 mills/kWh more than the licensing alternative adopted in this order. On balance, we believe that the benefits of relicensing the project with the mitigation and enhancement measures being required outweighs the increment of enhanced environmental values that license denial and dam removal would bring.

Annual Charges for Use of Tribal Lands Section 10(e) of the FPA provides: [W]hen licenses are issued involving the use of ... tribal lands embraced within Indian reservations the Commission shall . . . in the case of such tribal lands, subject to the approval of the Indian Tribe having jurisdiction of such lands . . . , fix a reasonable annual charge for the use thereof . . . , and such charges may with like approval be readjusted by the Commission at the end of twenty years after the project is available for service and at periods of not less than ten years thereafter upon notice and opportunity for hearing

As described above, at the time the original license was issued for the Shawano Project, the Menominee Reservation was a federal reservation. Subparagraph B of Article 23 of the original license provided for the annual charge of \$1,500 for –the use of tribal lands within the Reservation. Under Section 8 of the Termination Act, Interior ended federal ownership and supervision of the reservation effective April 30, 1961. At that point, the Menominee Tribe's right to Section 10(e) annual charges from the Shawano Project licensee ended. Wisconsin Power then entered into a private lease under which it paid the Tribe \$1,500 per year, and asked the Commission to delete Article 23 Subparagraph B. The Commission did so, effective September 1, 1962. In December 1973, the Menominee reservation was reestablished.

On October 22, 1996, the Menominee Tribe filed a petition requesting restoration, under the original license, of Subparagraph B of license Article 23, in light of the restoration of the Reservation's federal status, and back annual charges as of December 1973, for those years in which it asserts Wisconsin

Power did not make its \$1,500 lease payments (1974-78 and 1984- 85). The Tribe argues that, although the Commission removed the tribal land use provision (Subparagraph B) as of 1962, the original license incorporated by reference what is now Part I of the FPA, including Section 10(e), and that this is all the authority the Commission needs to reinstate retroactively an annual charge payment obligation. However, this theory of reserved authority was rejected in City of Seattle, Washington y.883 F.2d 1084, 1088 ((D.C. Cir. 1989).

The Tribe also requests that any new license issued for the project be conditioned on payment of "a reasonable annual charge in line with current dollar terms" for the project's occupancy of Reservation lands. The Commission's regulations, 18 C.F.R. § 11.4, state that the commission will determine annual charges for any project using tribal lands within an Indian reservation on a case-by-case basis. General Commission practice today is that annual charges on Indian reservation lands are to rest on agreements between the parties, whose terms (unless patently unreasonable) the Commission then incorporates into the license. Accordingly, as set forth in Article 203, we will afford the parties a period of time to negotiate an annual charge, subject to our approval.

CONSISTENCY OF THE PROJECT WITH THE PURPOSES OF THE MENOMINEE INDIAN RESERVATION:

Section 4(e) of the FPA states that the Commission may issue licenses within a reservation of the United States "only after a finding ... that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired The Treaty of May 12, 1854, provided that, in exchange for the cession of certain lands, the United States would give to the Menominee Tribe, a specific tract of land lying upon the Wolf River in the State of Wisconsin. The treaty states that the land is given "as a home, to be held as Indian lands are held," and provides for the development of institutions associated with settlement, such as a grist and saw mill, and a blacksmith shop.

The language in the Treaty of 1854, "to be held as Indian lands are held," has been interpreted to include the right to hunt and fish, and Interior and the Menominee Tribe state that, historically, the harvest of sturgeon from reservation waters of the Wolf River was an integral part of the Tribe's subsistence regime and figured in the Tribe's cultural and religious practices. Both Interior and the Tribe argue that the project dam prevents the passage of Lake Sturgeon to its historic spawning grounds at Keshena Falls, located on the reservation, and the Tribe maintains that the project therefore interferes with the purpose for which the Menominee Reservation was created.

However, as discussed in this order, the Shawano Project does not prevent the sturgeon from passing into the part of the Wolf River that passes through the reservation: the barrier is the downstream Shawano Paper Mill Project dam. The Shawano Project license reserves the Commission's authority to require a fishway at the Shawano Dam whenever Interior so prescribes. Thus, we find that nothing in the license will interfere or be inconsistent with the purpose of the Menominee Reservation.

STATE AND FEDERAL COMPREHENSIVE PLANS: Section 10(a) (2)(A) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. Federal and state agencies filed a total of 55 comprehensive plans for Wisconsin and seven for the United States. Of the 13 of these plans relevant to the Shawano Project, we find no conflicts.

APPLICANT'S PLANS AND CAPABILITIES

Consumption Improvement Program: The Wisconsin Public Service Commission has statutory and regulatory authority regarding least cost planning and energy conservation in the State of Wisconsin. Wisconsin Power promotes electric conservation among its member systems in compliance with the requirements and policies of the State Commission.

Wisconsin Power's plans and activities to promote conservation of electric energy and to reduce the peak demand for generating capacity include the installation of automated control systems, the efficiency evaluation and upgrade of the distribution system, the implementation of demand side management programs, and the dissemination of information on energy conservation to its customers. We conclude that Wisconsin Power is making a good faith effort to conserve electric energy.

Compliance History and Ability to Comply with the New License: We have reviewed Wisconsin Power's license application in order to judge its ability to comply with the conditions of any license issued, and with applicable provisions of Part I of the FPA. We have also reviewed its record of compliance under its existing license. Our review shows that Wisconsin Power has made timely filings and submittals and has maintained the project in a satisfactory manner under its existing license. Therefore, we conclude that Wisconsin Power will be able to comply with the terms and conditions of this subsequent license and other provisions of Part I of the FPA.

Safe Management, Operation, and Maintenance: Our Chicago Regional Office, in its inspection report dated September 10, 1991, concluded that the earth dam and the reinforced concrete powerhouse and spillway are in satisfactory condition. Both the left and right embankment have adequate vegetation cover. There was no evidence of any major sloughing or erosion on the crest or downstream slopes of the embankments. The upstream slopes of both embankments have adequate rip-rap for protection against wave action. No evidence of seepage was observed. Also, the steel Tainter gates appeared to be in good condition. No signs of any significant deterioration or other signs of structural distress were noted.

Efflorescence was observed on the spillway piers. The concrete of the piers in the tailrace area was not visible for inspection. The Regional Office classified the dam as having a low downstream hazard potential.

Based on Wisconsin Power's past safe management and operation of the project, we conclude that the project will be safe for continued operation during the new license term and will pose no threat to public safety if operated and maintained according to good engineering practices and our regulations governing hydroelectric licenses.

Ability to Provide Efficient and Reliable Electric Service: We reviewed Wisconsin Power's plans in its license application and its ability to operate and maintain the project in a manner most likely to provide efficient and reliable electric service. We conclude, based on our records of project inspection and compliance, that Wisconsin Power has been operating the project in an efficient manner within the

constraints of the existing license, and that it will continue to provide efficient and reliable electric service in the future.

Need for Power: Wisconsin Power reports to the Mid-America Interconnected Network Regional Reliability Council (MAIN). Each year MAIN prepares a coordinated bulk power supply program report for the Department of Energy. The MAIN IE-411 Report, dated April 1, 1995, projects the average annual summer load growth rate from 1995 to 2004 to be 1.6 percent and the average annual growth rate in annual energy requirements for the same period to be 1.63 percent. We conclude from these projections that electric power will continue to be needed in the region.

Based on the staff's evaluation of the electric power demand forecasts for the region, we conclude that the power from the project would continue to be useful in meeting a small part of the current and growing demand.

Transmission Services: Wisconsin Power proposes no new power development at the project, and therefore proposes no changes to the transmission network affected by project operations. Wisconsin Power will *continue* to use its current transmission *and* distribution system to transmit and distribute the project's power. This system is adequate, and we conclude that licensing the project to continue operations will have no significant effect on the existing transmission system.

Cost-Effectiveness of Plans: Wisconsin Power does not propose additional generating capacity, but it does propose environmental and recreational enhancements affecting existing project operation and environmental resources, including installation of an automation system to maintain head pond fluctuation within the plus and minus 0.3-foot tolerance limit; and improvement of the existing west bank fishing and boating access facility.

The EA discusses in detail the need for, usefulness of, and economics of the modifications proposed by Wisconsin Power, the resource agencies and the Commission staff. We conclude that the project, as currently constructed, and as Wisconsin Power proposes to operate it, with the agencies' and staff's modifications, fully develops and uses the hydropower potential of the site.

Compliance Record: We have reviewed Wisconsin Power's record of making timely filings and of complying with the terms and conditions of its existing license. We conclude that Wisconsin Power's overall record is satisfactory.

Actions Affecting the Public: The only action that would significantly affect the public would be beneficial: the public bank fishing and boating access improvements which will be required under the new license.

COMPREHENSIVE DEVELOPMENT: Sections 4(e) and 10(a) (1) of the FPA require the Commission, in acting on applications for license, to give equal consideration to the power development purposes and to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial

public uses. The decision to license this project, and the terms and conditions included herein, reflect such consideration.

The EA analyzed the effects associated with the issuance of the new license for Project No. 710. It recommends a number of measures to protect and enhance environmental resources, which we adopt, including: run-of-river operation and associated monitoring; limitation of water level fluctuations in the tailwater and downstream reach during debris sluicing; implementation of a stream flow gaging plan; maintenance of specified dissolved oxygen levels; monitoring of purple loosestrife in project waters; and development of a plan to preserve Bald Eagle nesting sites; as well as consultation with agencies on development of a fisheries enhancement plan and with the Corps of Engineers and the Menominee Tribe on studies to reduce flooding in the vicinity.

In determining whether to issue a new license for an existing hydroelectric project, the Commission considers a number of public interest factors, including the economic benefits of project power. Under our approach to evaluating the economics of hydropower projects, as articulated in Mead CokP., we use current costs to compare the costs of the project and of likely alternative power without regard to forecasts of potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of our analysis is to provide a general estimate of the potential power benefits and the costs of a project, and reasonable alternatives to project power. The analysis helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

In addition, certain economic factors related to project decommissioning impinge on the decision to issue a new license that are not present in the licensing of new projects. If an existing project subject to mandatory licensing is not issued a new license, or if the licensee declines to accept the new license, the project will have to be retired, which could range from simply removing the generator to major environmental restoration, up to and including dam removal.

In applying this analysis to the Shawano Project, we have considered the project with the applicant's mitigative proposals, the project with the Commission's and agency's adopted mitigative proposals, and decommissioning of the project by sealing the powerhouse and opening the spillway gates, as described above. The project, if licensed as Wisconsin Power proposes, would produce about 3,810,000 kilowatt hours (kWh) of energy annually, at an annual cost of about \$145,510, or about 38.2 mills/kWh. This is about \$22,900, or six mills/kWh, greater than the current annual cost of alternative power of about \$122,610, or about 32.2 mills/kWh. If licensed with staff's *recommended conditions*, project would continue to produce about 3,810,000 kWh of energy annually, but at a cost of about \$149,610 annually, or about 39.3 mills/kWh. This is about \$27,000, or 7.1 mills/kWh, greater annually than the current cost of alternative power. As noted, the cost of alternative power, including the costs of project decommissioning (\$206,000 annually, or 54 mills/kWh), far exceeds the costs of continuing to operate the project.

Although we find that continued operation of the project would be more economical than project retirement, Wisconsin Power must make the business decision whether to pursue the license in view of what appear to be the net economic costs of the project. Project economics are, moreover, only one of the many public interest factors we consider in determining whether or not, and under what conditions,

to issue a license. Based on our review of agency and public comments filed on this project, our review of staff's evaluation of the environmental and economic effects of the proposed project and its alternatives, and our analysis pursuant to FPA Sections 4(e) and 10(a) (1), we find that the Shawano Project, with our mitigative and enhancement measures, will be best adapted to the comprehensive development of the Wolf River for beneficial public purposes.

TERM OF THE LICENSE: Section 10(e) of the FPA specifies that any new license issued shall be for a term which the Commission determines to be in the public interest, but not less than 30 years nor more than 50 years from the date on which the license is issued. We apply this provision to subsequent licenses as well. The Commission's policy is to establish 30-year terms for projects with little or no redevelopment, new construction, new capacity or environmental measures; 40-year terms for projects with a moderate amount thereof; and 50-year terms for those projects with an extensive amount thereof. Wisconsin Power proposes no redevelopment of existing project facilities, no new construction, and no change in project capacity. The staff's recommended conditions do not decrease the amount of power produced annually by the project. In light of the relatively modest environmental mitigation and enhancement being required, the new license for the Shawano Project will be for a term of thirty years, effective the first day of the month in which this license is issued.

SUMMARY: Background information, analysis of impacts, support for related license articles, and the basis for our finding of no significant impact on the environment are contained in the EA. Issuance of the license is not a major federal action significantly affecting the quality of the human environment.

The design of the project is consistent with the engineering safety standards governing dam safety. The project will be safe if operated and maintained in accordance with the requirements of this license. Analysis of related issues is provided in the Safety and Design Assessment, which is available in the Commission's public file for this project.

The Commission orders: This license is issued to Wisconsin Power and Light Company (licensee) for a term of 30 years, effective the first day of the month in which this order is issued, to operate and maintain the Shawano Hydroelectric Project. This license is subject to the terms and conditions of the FPA, which is incorporated by reference as part of this license, and subject to the regulations the Commission issues under the provisions of the FPA.

The project consists of: All lands, to the extent of the licensee's interests in those lands, shown by FERC No 710- Showing Project Vicinity and Boundary Map

Project vicinity and Boundary Map: (2) Project works consisting of: (1) a 155-foot-long and 12.5-foot-high earth dam section with crest *elevation* at 823.5 feet National Geodetic Vertical Datum (NGVD); (2) a 41-foot-long by 68-foot-wide powerhouse section containing one 3-phase, 4,000-volt, 875-kVA generator driven by a vertical, 4blade, propeller type turbine, and rated at 700-kW; (3) a 115-foot-long reinforced-concrete gated spillway section with six 14-foot-wide by 14-foot-high electrically-operated Tainter gates, and an 8foot-wide by 73-foot-long rubbish sluiceway controlled with an 8-foot-8-inch by a 19-foot-7-inch sluice gate; (4) a 143-foot-long and 18-foot-high earth dam section with crest elevation at 823.5 feet NGVD; (5) 4,000-volt switchgear; and (6) appurtenant electrical and mechanical facilities.

The project works generally described above are more specifically shown and described by those portions of Exhibits A and F below:

Exhibit A: Pages A-1 through A-8 describing the existing mechanical, electrical and transmission equipment, and the proposed automation of the plant operation, filed June 30, 1992.

Exhibit F: The Exhibits A, F, and G described above are approved and made part of the license.

The following sections of the FPA are waived and excluded from the license for this minor project: 6, insofar as it relates to public notice and to the acceptance and expression in the license of terms and conditions of the FPA that are waived here; 10(f); 16; 19; 20; and 22.

The license is subject to the articles set forth in Form L-18 (October 1975), entitled "Terms and Conditions of License for Constructed Minor Project Affecting Navigable Waters and Lands of the United States, and the following additional articles:

Article 201. The licensee shall pay the United States an annual charge, effective on the first day of the month in which this license is issued, for the purpose of reimbursing the United States for the cost of administration of Part I of the Federal Power Act, as determined in accordance with the provisions of the Commission's regulations in effect from time to time. The authorized installed capacity for that purpose is 700 kilowatts. Under the regulations currently in effect, projects with authorized installed capacity of less than or equal to 1,500 kilowatts are not assessed an annual administrative charge.

Article 202. Within 180 days from the date of issuance of this order, the licensee shall file, for approval, a revised Exhibit G showing a project boundary for those lands of the Menominee Indian Reservation occupied by the project. Exhibit G shall contain a map identifying those federal lands: By legal subdivisions of a public land survey of the affected area; By the federal agency, identified by symbol or legend if desired, that maintains or manages each subdivision of the public land survey within the project boundary; and In the absence of a public land survey, by the location of the federal lands according to the distances and directions from fixed monuments or physical features.

Exhibit G shall contain inset sketches showing: relationships of the project works, natural features and property lines; one or more ties by distance and bearing from a definite, identifiable point or points on project works or the project boundary to established corners of the public land survey or other survey monuments: and, if the project affects unsurveyed Federal lands, the protraction of township and section lines recognized by the Department of the Interior.

Article 203. The licensee shall, subject to approval by the commission, negotiate with the Menominee Tribe a reasonable annual charge for the use of tribal lands. Within 180 days after the date of issuance of this license, the licensee shall file, for Commission approval, the negotiated agreement that stipulates the annual charge for use of tribal lands. The Commission reserves the right to make changes to this annual charge.

Article 204. Pursuant to Section 10(d) of the Federal Power Act, a specified reasonable rate of return upon the net investment in the project shall be used for determining surplus earnings of the project for

the establishment and maintenance of amortization reserves The Licensee shall set aside in a project amortization reserve account at the end of each fiscal year one half of the project surplus earnings, if any, in excess of the specified rate of return per annum on the net investment. To the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year, the Licensee shall deduct the amount of that deficiency from the amount of any surplus earnings subsequently accumulated, until absorbed. The Licensee shall set aside one-half of the remaining surplus earnings, if any, cumulatively computed, in the project amortization reserve account. The Licensee shall maintain the amounts established in the project amortization reserve account until further order of the Commission.

The specified reasonable rate of return used in computing amortization reserves shall be calculated annually based on current capital ratios developed from an average of 13 monthly balances of amounts properly includable in the licensee's long-- term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rate for such ratios shall be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity shall be the interest rate on 10-year government bonds (reported as the Treasury Department's 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Article 301. Within 180 days of completion of construction of facilities authorized by this license, including those facilities authorized in Article 412, the licensee shall file for approval, revised Exhibits F and G drawings, to show those project facilities as-built.

Article 401. The licensee shall cooperate in any future *efforts* by the U.S. Corps of Engineers (Corps) and the Menominee Indian Tribe of Wisconsin (Menominee *Tribe*) to study the formation of frazil ice and flood control in the Wolf River upstream of the Shawano Project dam and downstream from Keshena Falls on the Menominee Indian Reservation. The licensee's involvement shall begin at such time that studies of the issue are deemed appropriate by the Corps and the Menominee Tribe, and shall be limited to study provisions pertaining solely to the facilities and operations of the Shawano Project.

The licensee shall file, with the Commission, semi-annual status reports regarding the Corps' and the Menominee Tribe's initiation of such studies, as identified above. Such filings shall begin 180 days after the issuance date of this license, and by April 1 and October 1 of each year thereafter. The licensee shall continue to file the semi-annual status reports with the Commission until such time the Corps and the Menominee Tribe conclude the ice/flood control study. The annual status reports shall include a description of progress made in the previous year and the expected goals to be reached in the upcoming year.

Upon completion of any future frazil ice/flood control study, the licensee shall consult with the Corps and the Menominee Tribe concerning any measures needed at the Shawano Project to reduce flooding in the Village of Keshena in the future. Based on these consultations, and within 120 days of the study's completion, the licensee shall file with the Commission, for approval, a report discussing the results of the study and any recommendations (including the economic and environmental effects of such recommendations) by the licensee, the Corps, or the Menominee Tribe for changes to project facilities

and/or operations that would be needed for ice control at the Shawano Project. The report filed with the Commission shall also include all relevant documentation of the licensee's consultation with the Corps and the Menominee Tribe.

If the licensee, the Corps, and the Menominee Tribe identify a need for modifications of project facilities and/or operations to enhance flood control in the Village of Keshena, the Commission may direct the licensee to file with the Commission an amendment to the license to modify project facilities and/or operations, as appropriate.

Article 402. The licensee shall operate the project in a run-of-river mode for the protection of water quality and aquatic resources in the Wolf River. The licensee shall at all times act to minimize the fluctuation of the impoundment surface elevations by maintaining a discharge from the project so that, at any point in time, flows, as measured immediately downstream from the project tailrace, approximate the sum of inflows to the project impoundment. Under normal operating conditions, the licensee shall maintain the elevation of the Shawano Project impoundment at a target elevation of 818.0 feet National *Geodetic* Vertical Datum, with a fluctuation of no greater than ± 0.3 foot around the target elevation.

Run-of-river operation may be temporarily modified if required by operating emergencies beyond the control of the licensee, or for short periods upon mutual agreement between the licensee and the Wisconsin Department of Natural Resources (Wisconsin DNR). If the flow is so modified, the licensee shall notify the Commission as soon as possible, but no later than ten days after each such incident.

Article 403. Within 180 days after the date of issuance of this license, the licensee shall file with the Commission, for its approval, a plan to monitor compliance with the run-of-river mode of operation and downstream water level fluctuations requirements as stipulated in Articles 402 and 404. The monitoring plan shall include provisions for using the existing downstream U.S. Geological Survey (USGS) streamflow gaging station (USGS Gage No. 04077400) or some other similar gaging device installed in the project's tailrace, the existing control features, staff gages, and/or other appropriate monitoring/control features, to determine instantaneous head pond and tailwater elevations, and water surface elevations and flows in the Wolf River downstream of the project dam.

The plan shall include, but not be limited to, the proposed location, design, and calibration of the monitoring equipment, the method of flow data collection, a provision for providing flow data to the United States Fish and Wildlife Service (FWS), the USGS, and the Wisconsin Department of Natural Resources (Wisconsin DNR) within 30 days from the date of the agency's request for the data, and development of an annual report to be submitted to the FWS, USGS, and the Wisconsin DNR.

To provide for flow continuation during power outages and minimize extended periods without flow releases below the project, the plan shall include: (1) the development, in consultation with the FWS, USGS, and Wisconsin DNR, of any reasonable enhancement measures to minimize, to the extent possible, extended periods without flow releases downstream from the project; (2) the monitoring of downstream flow releases in accordance with this article; and (3) the development of a schedule for

implementing any or all of the enhancement measures identified during consultation with the resource agencies.

The monitoring plan shall also include a schedule for: (1) implementation of the program; (2) consultation with the appropriate federal and state *agencies* concerning the data from the *monitoring*; and (3) filing the data, agency comments, and licensee's response to agency comments with the Commission.

The licensee shall prepare the plan after consultation with the FWS, the USGS, and the Wisconsin DNR. The licensee shall include with the plan documentation of consultation and copies of comments or recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agency comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations prior to filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project specific information.

The commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 404. During debris sluicing operations, the licensee shall operate the project so that the tailwater and downstream reach of the Wolf River fluctuates by no more than 0.2-foot (2.4 inches), as measured at the existing downstream gaging station (USGS Gage No. 04077400), or some other similar gaging device installed in the project's tailrace, as provided for in Article 403 of this license.

The licensee shall maintain all records pertaining to compliance with this article, including, but not necessarily limited to, dates, times, and duration of all sluicing activities. The licensee shall also provide such data to the Fish and Wildlife Service, the U.S. Geological Survey, and the Wisconsin Department of Natural Resources, within 30 days from the date of the agency's request for the data.

Article 405. Within 180 days from the date of issuance of this license, the licensee shall file with the Commission, for approval, a plan to monitor dissolved oxygen concentrations (DO) and temperature in the Wolf River upstream and downstream of the Shawano Project for one year during the critical summer period of July 1 through September 15, and to maintain state water quality standards.

The purpose of this monitoring plan is to ensure that stream flows above and below the project, as measured upstream and immediately downstream of the Shawano Project, maintain a DO concentration of no less than 5.0 milligrams per liter(mg/l) and water temperatures of no greater than 89° Fahrenheit (F).

The monitoring plan shall include provisions for:(1) contain only monitoring DO and temperature upstream of the Shawano Project dam and downstream of the project powerhouse, and collecting DO and temperature profile data in the Shawano impoundment, with the sensor locations and monitoring frequency determined in consultation with the Wisconsin Department of Natural Resources (Wisconsin DNR) and the U.S. Fish and Wildlife Service (FWS); and (2) the preparation of enhancement measures

developed in consultation with the Wisconsin DNR and the FWS to address water quality conditions, mainly DO and water temperature, that deviate from the Wisconsin state standards.

The licensee shall prepare the plan after consultation with the Wisconsin DNR and FWS. The water quality monitoring plan shall include a schedule for: implementation of the program; consultation with the Wisconsin DNR and the FWS concerning the results of the monitoring; and filing the results, agency comments, and the licensee's response to agency comments, with the Commission.

The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the DO concentration and water temperature monitoring plan, including any changes required by the Commission.

If the results of monitoring indicate that changes in project structures or operations are necessary to ensure maintenance of the state DO and water temperature standards downstream, the Commission may direct the licensee to modify project structures or operations.

Article 406. The licensee shall cooperate with the Wisconsin Department of Natural Resources (Wisconsin DNR), the Fish and Wildlife Service (FWS), and the Menominee Indian Tribe (Tribe) to develop and implement a comprehensive river/fisheries management plan for the Wolf River. The licensee's involvement shall begin at such time a plan is deemed appropriate by the Wisconsin DNR and the FWS, and *shall be* limited to providing information on operational considerations and design criteria for fish passage at the Shawano Project.

Annual status reports shall be filed with the Commission, beginning one year after the date this license is issued and by October 1 of each year thereafter. The licensee shall continue to file the annual status reports with the Commission until the final Wolf River fish management plan has been filed with the Commission. The annual status reports shall include a description of progress made in the previous year and the expected goals to be reached in the upcoming year.

If, upon completion of the final Wolf River fish management plan, the licensee, the FWS, the Wisconsin DNR, and the Tribe identify a need for modifications of project operations and/or structures to accommodate fish passage at the Shawano Project, the Commission may direct the licensee to file with the Commission an amendment to the license to modify project operations and/or structures.

Article 407. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of, such fishways, as may be prescribed by the Secretary of the Interior.

Article 408. Within 180 days from the date of issuance of this license, the licensee shall file with the Commission, for approval, a fishery enhancement plan for the Shawano Project. The purpose of this plan, which shall have an annual cost not to exceed \$4,100 (in 1993 dollars), through the term of this license, is to enhance the aquatic habitat and the fishery in the project impoundment.

The plan shall include, but not necessarily be limited to: detailed descriptions of the type of structural or physical habitat improvement(s) carried out, or of any other type of fish enhancement measure(s) proposed, for the project impoundment; (2) a map identifying the location(s) of any structural or physical habitat improvements identified in the descriptions in (1), above; (3) descriptions of the methods to transport and install such habitat improvement(s), including a description of the measures used to minimize disturbance to the terrestrial and aquatic habitat; and (4) a schedule for implementing the fishery enhancement plan. The plan shall also include a provision for filing five-year status reports, with the Commission, beginning one year after issuance of this license, identifying the progress made in the previous five-year period, and the expected goals to be reached in the upcoming five-year period.

The licensee shall prepare the fishery enhancement plan *after* consultation with the U.S. Fish and Wildlife Service (USFWS), the Wisconsin Department of Natural Resources (Wisconsin DNR), and the Menominee Indian Tribe of Wisconsin (Menominee Tribe). The licensee shall include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after the plan has been prepared and provided to the agencies and the Menominee Tribe, and specific descriptions of how the agencies' and the Menominee Tribe's comments are accommodated by the plan.

The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 409. Within six months from the date of issuance of this license, the licensee shall file with the Commission for approval a plan to monitor, at least annually, purple loosestrife (*Lythrum salicaria*) in project waters. The plan shall include, but not be limited to: (1) a description of the monitoring method; (2) a monitoring schedule; and (3) a schedule for providing the monitoring results to the Wisconsin DNR and the FWS. The licensee shall prepare the plan after consultation with the Wisconsin DNR and the FWS. The licensee shall include with the plan documentation of consultation and copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan.

The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations prior to filing the plan with the Commission. If the licensee does not adopt a recommendation the filing shall include the licensee's reasons based on project specific information.

The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Article 410. Within six months from the date of issuance of this license, the licensee shall file with the Commission, for approval, a plan developed in consultation with the U.S Fish and Wildlife Service and the Wisconsin Department of Natural Resources, to preserve all suitable Bald Eagle nest trees, such as large white pines and red pines, located on project lands as potential sites for the Bald Eagle (*Haliaeetus leucocephalus*), a federally listed threatened species in Wisconsin.

Article 411. The licensee shall implement the provisions of the "Programmatic Agreement Among the Federal Energy Regulatory Commission, the Wisconsin State Historic Preservation Office, and the Advisory Council on Historic Preservation, for the Management of Historic Properties That May Be Affected by a License Issuing to Wisconsin Power & Light Company to Continue Operating the Shawano Hydroelectric Project. The Commission reserves the authority to place such additional requirements upon this license as may be necessary to ensure the Commission's compliance with the National Historic Preservation Act and 36 CFR BOO, at any time during the term of this license, in the event the Programmatic Agreement is terminated.

Article 412. Within two years from the date of issuance of this license, the licensee shall construct and provide for the operation and maintenance of the following improvements at the existing boat access area on the west bank of the flowage owned by the town of Richmond: (1) pave the access road; (2) provide parking for 2-3 vehicles with trailers; and (3) install a prefabricated concrete boat ramp.

The licensee shall construct the facilities after consultation with the Wisconsin Department of Natural Resources (DNR), the US Fish and Wildlife Service (FWS), the National Park Service, and the town of Richmond. These facilities shall be shown on the as-built drawings filed pursuant to this license.

The licensee shall file a report with the as-built drawings which shall include the entity responsible for operation and maintenance of the facilities and access, and documentation of consultation and copies of comments and recommendations on the report after it has been prepared and provided to the agencies, including specific descriptions of how the agencies' comments are accommodated by the report. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations prior to filing the report with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

Article 413. (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types or use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also have continuing responsibility to supervise and control the use and *occupancies for which* grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee shall take any lawful action necessary to correct

the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

The types of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than ten watercraft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee shall require multiple use and occupancy of facilities for access to project lands or waters.

The licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline.

To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

The licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where *all* necessary state and federal approvals have been *obtained*; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; telephone, gas, and electric utility distribution lines; non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project

lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than ten watercraft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Hydropower Licensing, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the licensee 'to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article: Before conveying the interest, the licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer. Before conveying the interest, the licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee shall take all reasonable precautions to insure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee shall not unduly restrict public access to project waters.

The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed

under this article from the project shall be consolidated for consideration when revised Exhibit G or K drawings would be filed for approval for other purposes.

The authority granted to the licensee under this *article* shall not apply to any part of the public *lands* and reservations of the United States included within the project boundary.

The licensee shall serve copies of any Commission filing required by this order on any entity specified in this order to be consulted on matters related to that filing. Proof of service on these entities must accompany the filing with the Commission.

This order is final unless a request for rehearing is filed within 30 days of the date of issuance of this order. Requests for rehearing may be filed within 30 days of the date of this order pursuant to 18 C.F.R. § 385.813.

The filing of a request for rehearing does not operate as a stay of the effective date of this order or of any other date specified in this order, except as specifically ordered by the Commission. The licensee's failure to file a request for rehearing shall constitute acceptance of this license.

By the Commission.

Lois D. Cashell, Secretary.

Appendix B: Balsam Row License Amendment

(Original license amendment with all the citations can be located at www.ferc.gov)

UNITED STATES OF AMERICA 116 FERC 62,166 FEDERAL ENERGY REGULATORY COMMISSION

Wolf River Hydro Limited Partnership Project No. 710-038

ORDER AMENDING LICENSE (Issued August 28, 2006)

On April 27, 2006, Wolf River Hydro Limited Partnership (licensee) filed a request to amend the project license for the Shawano Project, located on the Wolf River in Shawano County, Wisconsin, and in part within the Menominee Indian Reservation. The licensee states that the amendment application is the result of a collaborative effort to resolve pending court appeals regarding the new license, issued on May 16, 1997.

The licensee's April 27 filing included a Settlement Agreement (SA) between the licensee, the Menominee Indian Tribe of Wisconsin (Tribe) and the U.S. Department of the Interior (Interior), acting through the Bureau of Indian Affairs (BIA) and the U.S. Fish and Wildlife Service (FWS). In addition, the licensee states that the Wisconsin Department of Natural Resources (WDNR) concurs with the proposals. The licensee requests amendment of the license as described below and an extension of the project license term to 2037. The current license expires in 2027.

An Environmental Assessment (EA) was prepared regarding the amendment application and is attached to this order. In this order, I amend the license in accordance with the application because I find that the licensee's proposed measures are beneficial, will have no significant adverse impact on the human environment, and is in the public interest.

BACKGROUND: The project license was issued on May 16, 1997. The Tribe and Interior filed requests for rehearing on June 16, 1997. The Tribe and Interior argued that the Commission erred in issuing a new license that did not incorporate Interior's conditions filed on May 13, 1997, pursuant to Section 4(e) of the Federal Power Act (FPA).

On March 15, 2001, the Commission issued an order that considered Interior's conditions as recommendations under Section 10(a) of the FPA. These recommendations included: (1) project operation; (2) gaging; (3) funding of trap and transport operations for Lake Sturgeon; (4) upstream and downstream fish passage; (5) installation of ice booms to minimize flooding; (6) mussel restoration; and (7) habitat studies in the project reservoir. The Commission amended article 401 (which required the development of a plan for the control of frazil ice); added the Tribe as an entity to be consulted with in the development of the various plans and type of operation required by articles 402, 403, 405, 409, and 410; added article 414 which required a plan for the licensee's participation in the May 1995 Menominee Reservation-Lake Sturgeon Management Plan; and denied rehearing in all other respects, with the exception of annual charges.

The Tribe and Interior sought review of the Commission's March 2001 rehearing order in the United States Court of Appeals for the District of Columbia Circuit. The case remains pending. The licensee states that amending the license, as proposed, would effectively render the appeal moot.

AMENDMENT REQUEST: In the application, the licensee proposes five new license articles (articles 415-419) and modifications to five existing articles (articles 401, 403, 408, 409, and 414). In addition, the licensee requests to extend the project license term to 2037. These requests are detailed below.

Establishment of Shawano Resource Enhancement Fund (Article 415): First, the licensee proposes the establishment of a Shawano Resource Enhancement Fund. The licensee states that although the article requires payments into a fund, it also requires specific project-related mitigation measures also required by the license. The Commission would retain jurisdiction over the licensee's performance of the agreed upon mitigation. Further, annual consultation and reporting is proposed to assure all parties that the funds were expended for the specific measures intended. The licensee proposes the new article, article 415, would state:

Article 415. The licensee, together, with the Menominee Indian Tribe of Wisconsin, shall establish the Shawano Resource Enhancement Fund no later than 60 days after the date of this order. The Fund shall be established for the mitigation measures set forth in articles 401, 409, and 414, and new articles 416, 417, 418, and 419 as set forth in this order. If any of the payments required are not paid within 30 days of the due date specified in each article, interest shall accrue at the rate of 6% per annum, owing on the unpaid amount from the specified due date until paid. All interest accrued in the Fund shall be applied in fulfillment of these articles on a pro rata basis after adjustment for the payment of any fees and/or taxes assessed upon the fund.

By March 1 of each year, the licensee shall file with the Commission an Annual Accounting Report that describes the activities that have been funded by the Shawano Resource Enhancement Fund in the previous year and anticipated activities and associated costs for the coming year. The report shall include proof of consultation with and any comments from the Tribe, the FWS, the BIA, and the WDNR. The licensee shall allow the Tribe and the agencies a minimum of thirty days to comment and to make recommendations before the report is filed with the Commission. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons, based on project-specific information. The report shall also include any letters of comment from the Tribe and the agencies.

A. Control of Frazil Ice (Article 401): Currently, article 401 requires the licensee to consult with the FWS, WDNR, Tribe and the U.S. Army Corps of Engineers and develop and file, for Commission approval, a plan to control frazil ice at the project. The plan shall evaluate the feasibility of alternatives to alleviate the frazil ice related flooding at the project, including the installation of ice-booms, or other changes to project facilities and/or operations. Rather than file this plan, the licensee now proposes installation of ice booms at the project.

Specifically, the licensee proposes that article 401 be amended as follows:

Article 401. The licensee shall be responsible for the construction and installation of steel frazil ice booms to alleviate frazil ice flooding at the Shawano Project, as follows: No later than September 1, 2006 and September 1, 2007 the licensee shall deposit \$5,000 each year into the Shawano Resource Enhancement Fund, established pursuant to article 415 of this license, to be used for the purpose of construction and installing frazil ice booms. No later than September 1, 2008, the licensee shall contribute an additional \$7,000 to the Shawano Resource Enhancement Fund for the same purpose. In the event the initial cost or replacement cost of frazil ice booms exceeds \$55,000 in the aggregate, the licensee shall contribute, in addition to the \$17,000 identified above, 50 percent of the cost above \$55,000, but not to exceed an additional \$8,000. The licensee shall submit a plan and design to the Commission for approval prior to construction and installation. The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall commence construction and installation, including any changes required by the Commission, on or before June 1, 2010.

The licensee shall consult with the Tribe and the BIA annually to discuss the status of construction efforts, operation and maintenance concerns, and any other relevant issues. The Annual Accounting Report required by article 415 shall describe efforts to fulfill this license obligation during the previous year and anticipated efforts and costs for the coming year.

The licensee states that the licensee's monetary contribution to the construction of ice booms would not exceed \$25,000. Once constructed and installed, the Tribe would be responsible for annual removal, installation, storage, repair, and maintenance of the ice booms.

B. Fisheries Enhancement (Article 408): Article 408 originally required the licensee to consult with the FWS, WDNR, and the Tribe and develop a fishery enhancement plan for the project which shall have an annual cost not to exceed \$4,100 (in 1993 dollars), through the term of the license. The licensee filed the plan on August 5, 1999. The plan was modified and approved by the Commission on November 30, 1999. Subsequently, the licensee filed proposed modifications to the plan on February 29, 2000, which were approved by the Commission by order issued May 15, 2000.

The approved plan requires the improvement/enhancement of six sites in the project impoundment. Improvements include rip rap of the shoreline, use of half-logs in some areas, use of anchored tree drops, and enhancement of marsh areas with vegetation. The approved plan also requires the filing of annual reports on the status of the enhancement work. The licensee proposes the following new language to replace the existing article 408:

Article 408. The licensee shall implement the terms of the fishery enhancement plan approved and modified by Commission orders dated November 30, 1999 and May 15, 2000. The purpose of this plan is to enhance the aquatic habitat and the fishery in the project impoundment. From the year of issuance of this order through and including 2006, the licensee shall contribute \$5,200 (in 2003 dollars) annually, due no later than December 31 of each year, into the bank account existing at Fifth Third Bank i Petoskey, Michigan. No later than December 31, 2007, the licensee shall contribute an additional \$2,500 to said bank as a 2007 payment to the abovementioned bank account, after which the licensee's funding obligation will cease. Annual contributions shall be indexed according to the Consumer Price Index and are to be used for the sole purpose of funding the approved fishery enhancement plan. Funds will be

subject to disbursement following consultation with the Tribe and based on mutual agreement. The licensee shall provide the Tribe monthly bank statements reflecting activity in the account. The licensee's obligations to implement the substantive terms of the fishery enhancement plan will continue until all required mitigation set forth therein is completed.

The licensee shall file with the Commission an annual report on the status and schedule of the enhancement work and the results of any studies on the effectiveness of the enhancement measures. This report shall be filed no later than March 1 of each year for the previous year's activities and until enhancement of all sites identified in the approved fishery enhancement plan is completed. The licensee shall provide the reports to the FWS, the WDNR, and the Tribe, allowing 30 days for comments, before filing the reports with the Commission. The reports shall include any letters of comment from these entities.

The licensee states that to date, the following enhancement measures have been completed at three of the five sites: (1) Site 3-installation of half logs in the stream near the edge of the channel to improve in-stream cover; (2) Site 4-installation of rip-rap along eroding shoreline and boulder placement along the bank; and (3) Site 5-installation of rip-rap along eroding shoreline and boulder placement along the bank. The licensee states that Sites 1 and 2, which are shoreline rock placement projects, have not been completed. Before these sites can be completed, road access must be developed. The licensee believes that the current fund, together with the proposed contributions through 2007 would provide sufficient funds to complete the work.

C. Purple Loosestrife Removal (Article 409): Article 409 of the license required the licensee to consult with the Tribe, the FWS, and the WDNR and develop a plan to monitor, at least annually, purple loosestrife in projects waters.

The plan was to include: (1) a description of the monitoring method; (2) a monitoring schedule; (3) a schedule for providing the monitoring results to the WDNR, FWS, and the Tribe. The licensee filed its plan on November 13, 1997. The Commission approved the plan on May 3, 1999.

In part, the approved plan requires the licensee survey for purple loosestrife between July 15 and September 1 of each year, documenting the dominant and spot occurrences on maps. Further, the licensee is required to submit annual reports to the WDNR and the FWS by December 31 of each year, and file them with the Commission (with any agency comments) by February 1 of the following year. Replacing the existing language of article 409, the licensee proposes the following:

Article 409. The licensee shall monitor and survey purple loosestrife on an annual basis and in accordance with the approved Purple Loosestrife Monitoring Plan, 87FERC ¶ 62,123 (1999), until the end of 2005, after which the licensee's responsibility to monitor purple loosestrife shall cease. The final monitoring report shall be filed with the Commission no later than December 31, 2006. Commencing December 31, 2007, and through and including December 31, 2016, the licensee shall contribute \$1,500 per year to the Shawano Resource Enhancement Fund established pursuant to article 415 of this license. These funds shall be expended by the licensee, at the direction of the Tribe, for the purpose of eradicating purple loosestrife within the project boundary as approved by the Commission, 94 FERC ¶ 61,294 (2001).

The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis through and including the year 2016 to discuss appropriate purple loosestrife eradication efforts. Eradication efforts should be in compliance with the approved Purple Loosestrife Monitoring Plan. The Annual Accounting Report required by article 415 of this license shall describe eradication efforts during the previous year and anticipated efforts for the coming year.

Given its limited resources, the licensee proposes that future efforts be focused on eradication of purple loosestrife rather than continued monitoring. The licensee speculates that beetles used for control of purple loosestrife may be self-supporting by 2016 or that full eradication may occur by then.

D. Downstream Flow Gaging Station (Article 403): Article 403 of the license required the licensee to consult with the FWS, the Tribe, the WDNR, and the U.S. Geological Survey (USGS) and develop a plan to monitor compliance with the run-of-river mode of operation and downstream water level fluctuation limits during debris sluicing as stipulated in articles 402 and 404, respectively. The monitoring plan was to include provisions for using the existing downstream USGS gage (USGS Gage No. 04077400), as well as using other equipment to monitor head pond elevations. This plan was filed with the Commission on November 13, 1997 and was approved by the Commission on April 27, 1999.

The licensee now proposes that the following paragraph be added to the existing language of article 403:

No later than 30 days after the issuance date of this order, the licensee shall place in operation a website providing data from the existing downstream flow gaging station. Data from the flow gaging station shall be recorded in hourly increments, and the website updated twice daily at approximately 8:00 a.m. and 6:00 p.m. CST. The licensee shall be responsible for the continued operation and maintenance of the website for the life of the license and shall provide sufficient upgrades as necessary to accommodate changes in technology, as determined in consultation with the Tribe. The licensee shall be responsible for one-half of the monthly cost to operate and maintain the website, with the Tribe responsible for the remaining half of the monthly cost to operate and maintain the website. The licensee shall make website data available to the Tribe, the WDNR, the BIA, the FWS, the USGS, and the Commission.

The licensee states that in the interest of settlement, the licensee and Tribe have agreed to jointly fund a private website that will display data from the existing downstream flow gaging station. This would allow independent verification of compliance by the Tribe and resource agencies. The licensee states that joint funding with the Tribe allows for consideration of the economic realities of the project and the interests of the consulting parties, while contributing to the dismissal of a long-pending court appeal.

E. Upstream Gaging Station (Article 416): Prior to the Commission's approval of the gaging plan, the agencies had recommended the establishment of a gage at the head of the project reservoir. In the order approving the gaging plan, Commission staff determined that an upstream gage was not needed. The licensee proposes that a new license article pertaining to an upstream gaging station be added to the license:

Article 416. Not later than December 31, 2006, the licensee shall make a one-time payment to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used towards the installation of an upstream USGS gaging station. The amount of the payment shall be \$3,250 in the event

costs for installing the upstream gaging station are \$10,000 or higher. The amount of the payment shall be 25 percent of the costs for installing the upstream gaging station if such costs are less than \$10,000. In addition, beginning on September 1, 2006, the licensee shall pay \$1,200 annually (without adjustment for inflation) to be used exclusively for annual maintenance costs for the upstream gaging station. This \$1,200 annual payment shall be deposited into the Shawano Resource Enhancement Fund and is required for the remainder of the license term. The gaging station shall be located within the Project boundary.

The licensee states that installation of an upstream USGS gage would allow for: (1) independent verifications of inflows to the project; (2) verification of licensee data on project operation; (3) backup flow and river stage data when the licensee's equipment is inoperable; (4) additional data during high flow events; (5) data to be used by the Tribe for flood forecasting on the Reservation, particularly when ice jam/flooding problems occur at Keshena Falls; (6) independent verification of river stage if it is suspected that operations are adversely affecting archaeological/cultural resources on the Reservation; and (7) quick access by the Tribe and resource agencies to flow data in order to respond to public complaints. As above, the licensee states that joint funding with the Tribe allows for consideration of the economic realities of the project and the interests of the consulting parties, while contributing to the dismissal of a long pending court appeal.

F. Trap and Transport of Lake Sturgeon (Article 414): The existing article 414 requires the licensee to consult with the FWS, WDNR, and Tribe and develop and file, for Commission approval, a plan for its participation in the May 1995 Menominee Reservation-Lake Sturgeon Management Plan. The licensee proposes article 414 be amended as follows:

Article 414. The licensee shall participate in the May 1995 Menominee Reservation-Lake Sturgeon Management Plan ("Plan") as follows: The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis to discuss ongoing trap and transport operations and to assess the continuing need for such operations, and shall include a report on such consultations in the Annual Accounting Report required in article 415 of this license. Commencing September 1, 2006, the licensee shall contribute \$1,500 annually to the Shawano Resource Enhancement Fund established in article 415 of this license, to be used for the purpose of trap and transport of Lake Sturgeon in accordance with the Plan. This annual payment is due no later than June 30 of each year and shall continue until an upstream fish passage facility is installed and operational, or until the Commission determines following consultation as set forth above, that trap and transport is no longer necessary, at which time the licensee's annual \$1,500 contribution for trap and transport of Lake Sturgeon shall cease.

The licensee's application included a 2004/2005 Menominee Lake Sturgeon Management Activities on Wolf River, Balsam Row Dam to Shawano Paper Mill Dam Tracking Results (Appendix D) which indicated that Lake Sturgeon released upstream in reservation waters have migrated downstream of the project dam. These fish remain there and are using the river between the Shawano Project and the Paper Mill Project (FERC No. 8015), located 5.3 miles downstream. The licensee speculates that these sturgeons may swim to the base of the project dam looking for upstream passage. Monies proposed in this article would be provided to the Tribe to cover the costs incurred for trap and transport operation.

G. Installation of Upstream Fish Passage (Article 417): The licensee states that the parties have agreed that installation of an upstream fish passage facility is the most appropriate means of addressing the project's blockage of upstream passage of Lake Sturgeon. A prototype facility (a spiral side-baffle fish ladder) has been developed that will pass sturgeon. The licensee states that existing information documents that riverine species, including Lake Sturgeon, are known to travel long distances upstream and downstream on spawning runs. The licensee proposes the following new article:

Article 417. The licensee shall be responsible for the installation of an upstream fish passage facility, as follows: The licensee shall contribute \$5,000 per year commencing January 1, 2008, through and including January 1, 2012, and \$10,000 per year commencing January 1, 2013, through and including January 1, 2016, to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used by the licensee for the purpose of installing an upstream fish passage facility. The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis starting in 2008 to discuss construction plans and designs, the target species for passage, and a schedule for fulfilling this license obligation. The licensee shall obtain the approval of the FWS and the WDNR regarding the functional and technical feasibility of the construction plans and designs prior to installing an upstream fish passage facility. Such plans and designs shall also be submitted to the Commission for approval and must be approved by the Commission before being implemented or constructed by the licensee.

Starting in 2008, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of an upstream fish passage facility during the previous year and anticipated efforts for the coming year. Installation of an upstream fish passage facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the downstream fish protection facility requirement contained in article 418, does not exceed more than 5 percent of average annual generation.

The licensee states that the proposed article allows for \$65,000 to be used exclusively for the construction and installation of an upstream fish passage facility. As discussed in the SA, the Tribe agrees to be responsible for obtaining any additional funds necessary for the design and construction of fish passage. Once funds are available, the licensee is responsible for its construction, with design approval from the Commission, FWS, and the WDNR. Provided that the licensee complies with the license terms relating to fish passage as proposed here, the SA further states that Interior has agreed not to exercise section 18 authority for the remainder of the license term.

H. Installation of Downstream Fish Passage (Article 418): As discussed above regarding upstream passage, the licensee agrees that downstream passage is an appropriate means of contributing to healthy resident fish populations both above and below the project. The license states that fish entrainment is not solely a biological issue, but also is important in that it results in mortality of fish resources that are culturally and nutritionally essential to the Tribe. Therefore, the licensee proposes the following new article be included in the license:

Article 418. The licensee shall be responsible for the installation of a downstream fish protection facility, as follows: Commencing July 1, 2017 and continuing through and including July 1, 2021, the licensee shall contribute \$11,000 annually to the Shawano Resource Enhancement Fund established in Article 415 of the

license, to be used by the licensee for the purpose of the study, planning and installation of a downstream fish protection facility. The licensee shall obtain the approval of the FWS and the WDNR regarding the functional and technical feasibility of the construction plans and designs prior to installing a downstream fish passage protection facility.

Starting on or before July 1, 2015, the licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis through and including the year 2021 to discuss study plans and results, construction plans and designs, a schedule for fulfilling this license obligation and any other relevant issues. Starting in 2015, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of a downstream fish protection facility during the previous year and anticipated efforts for the coming year. Any plans and designs shall also be submitted to the Commission for approval and must be approved by the Commission before being implemented or constructed by the licensee. Installation of a downstream fish protection facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the upstream fish passage requirement contained in article 417, does not exceed more than 5 percent of average annual generation.

Per the proposed article, a total of \$55,000 would be provided to fund downstream fish passage. As with upstream passage, the Tribe would be responsible for obtaining additional funds for the facility. The licensee would be responsible for the construction of the facility.

I. Freshwater Mussel Restoration (Article 419): In the Commission's March 15, 2001 order on rehearing, the Commission speculated that the presence of certain mussel species below the dam, but not above, could simply be a normal characteristic of mussel distribution in Wolf River, and not population fragmentation caused by the existence of the project as DOI asserted. The parties now have agreed on a provision requiring the licensee to fund and implement a plan for freshwater mussel restoration. The licensee proposes the following article:

Article 419. Not later than January 1, 2016, the licensee shall file with the Commission a plan for freshwater mussel restoration. The licensee shall be responsible for implementation of the plan, as follows: Commencing January 1, 2017, and continuing through and including January 1, 2026, the licensee shall contribute \$1,750 annually to the Shawano Resource Enhancement Fund established pursuant to article 415 of this license, to be used by the licensee for the purpose of freshwater mussel restoration. The licensee shall consult with the Tribe, the FWS, the BIA and the WDNR on an annual basis starting on or before January 1, 2015 and through and including the year 2026 to discuss plans and schedules for freshwater mussel restoration efforts.

The licensee shall provide the draft plan to the FWS, the WDNR and the Tribe for review, allowing 30 days for comments before filing the plan with the Commission. The plan shall include any letters of comment from these entities. The Commission reserves the right to require changes to the plan.

J. License Term Extension Request: Lastly, the licensee proposes to extend the term of the project license to April 30, 2037. The licensee argues that it has agreed to numerous additional environmental mitigation measures and that implementation of these measures result in a significant financial obligation. The

licensee states its funding obligations under the Settlement Agreement range from \$210,250 to \$218,250, depending on whether the full additional \$8,000 contribution is necessary for frazil ice booms. Given the size of the project and its revenue, the licensee contends the license term extension is both reasonable and warranted.

CONSULTATION AND PUBLIC NOTICE: The SA included with the application, was signed by the licensee (represented by attorney), the Tribe, the BIA, and the FWS. By letter dated October 2005, the WDNR concurred with the licensee's proposals.

The Commission issued a public notice of the application on May 16, 2006, with a comment period ending June 16, 2006. The DOI (on behalf of the BIA and FWS) and the Tribe filed Motions to Intervene on June 14, and 16, 2006, respectively. In their respective filings, both DOI and the Tribe expressed support of the licensee's amendment request. On June 19, 2006, DOI filed a letter stating that it had no additional comments on the application. No other parties filed comments in response to the notice.

In addition to the Commission's public notice and pursuant to Section 106 of the Historic Preservation Act, it requested concurrence from State Historical Society of Wisconsin (SHPO) that the licensee's proposed amendment application would have no effect on cultural or historic properties in the project area. No response was received.

DISCUSSION: First and foremost, I acknowledge the party's efforts in developing the SA and proposed license articles. As the licensee, correctly states, the Commission generally favors the development of settlement agreements and often adopts many of the provisions included in them. In the case, here, the licensee, the Tribe, the BIA, and the FWS have come to agreement on a number of issues, including frazil ice prevention, fishery enhancement, purple loosestrife eradication, upstream and downstream gaging, trap and transport of Lake Sturgeon, upstream and downstream fish passage, and freshwater mussel restoration. Treatment of these resources at this project is the subject of a lengthy appeal, and I appreciate the effort expended by all the parties in resolving these issues.

A. The SA's Proposed Measures: As discussed in the attached EA, I find that completing work at the Commission- approved fishery enhancement sites, purple loosestrife eradication, assisting in the trap and transport of Lake Sturgeon, upstream and downstream fish passage, and developing a plan for freshwater mussel restoration in the project area will benefit environmental resources in the area. Installation of ice booms will minimize the potential for frazil ice- related flooding in the village of Keshena and the proposed gaging will allow for more complete and easily obtainable data for determining compliance. In accordance with the SA, the license will be amended to provide for these measures.

B. The SA's Funding Proposals: As explained above, the SA proposes adoption of a license amendment to provide for a fund to pay for the various measures listed above (article 415) as well as for amendments to various articles adding provisions related to the spending of funds and funding limits (articles 401, 403, 408 and 409, 414, and 416 through 419). The licensee notes that mitigation funds have been approved by the Commission in the past.

Settlements filed with the Commission often include specific dollar limitations, and the limitations sometimes are included in license articles at the parties' request, in an effort to revise proposed articles as little as possible. However, it is important for all entities involved in settlements to know that the Commission considers the licensee's obligation to be to complete the measures required by license articles, in the absence of authorization from the Commission to the contrary. Dollar figures agreed to by parties are not absolute limitations. The Commission's purpose in crafting license articles is to ensure that the licensee will complete the environmental measures required in the license, not that it spend a particular amount of money. Accordingly, in this instance, although the Shawano license will be amended to incorporate the proposed funding provisions as well as the negative impact on generation limits, article 420 will also be added to the license reserving the Commission's authority, notwithstanding the limitation on expenditures included in the license, to require the licensee to undertake such measures as may be appropriate and reasonable to implement the requirements of the license.

In revisions to article 403, the licensee proposes that the Tribe will provide additional funds for the establishment of a website to be used to display data collected at the downstream gage. Since the Commission only has jurisdiction over the actions of the licensee and could not enforce such a provision concerning the Tribe, this provision will not be included in the amended license. However, the parties' agreement for tribal provision of additional funds is not inconsistent with the Federal Power Act. The parties therefore are free to abide by that agreement and, if necessary, to pursue enforcement of the agreement in an appropriate forum.

C. Frazil Ice Booms: Regarding the installation of the proposed frazil ice booms, the licensee only notes that the current proposed location for the ice booms is on tribal lands. Approving this measure would mean that installation of the booms would be required and made part of the license. Thus, the booms would become project features. Given this fact and the schedule for installation in the near future, i.e., before 2010, the booms and the lands on which they are installed must be included within the project boundary, in accordance with standard Article 5 of the license. As such, I am requiring the licensee file revised exhibits F and G.

D. Purple Loosestrife: The Licensee's proposed article 409 provides for it to contribute \$1500 per year to the Shawano Resource Enhancement Fund, to be expended for the purpose of eradicating purple loosestrife within the project boundary, from December 31, 2007 through December 31, 2016. The licensee suggests that biocontrol efforts will eliminate the species from the project area by 2016. As discussed in the attached EA, there is no guarantee that this will occur. Therefore, the proposed article 409 will be modified to require eradication efforts to continue beyond 2016, and throughout the remainder of the license term. The continued eradication efforts will be required notwithstanding the limitation on expenditures included in the license article. If and when the evidence presented in the annual reports to be filed pursuant to article 415 document species eradication, the licensee may request that the Commission revisit this matter.

The proposed article 409 will also be modified to eliminate the language stating that funds will be expended by the licensee "at the direction of the Tribe." This language will not be adopted because to do so would be to relinquish to the Tribe the Commission's authority and responsibility to administer the license. However, the proposal will be substantially satisfied by a requirement that the licensee's

expenditures be made in consultation with the Tribe.

E. License Term: The licensee requests a license term of 40 years, i.e., to April 30, 2037. The licensee estimates that the costs associated with its proposed environmental measures would be approximately \$210,250 to \$218,250 depending on whether a full additional \$8,000 is necessary for frazil ice boom installation. Thus, at a minimum, assuming the licensee's cost of \$210,250 at 8 percent interest, the annual cost of the proposed measures would be approximately \$21,000.

The project as licensed, including the measures discussed above, will require a moderate amount of new environmental measures with associated construction and expense. Therefore, I will grant the request for a 40-year license term ending April 30, 2037.

The licensee's request to amend the license, as modified above, is granted.

The Director orders:

The license for the Shawano Project No. 710 is amended as set forth in ordering paragraphs (B) through (M) below.

Article 401 of the license for Project No. 710 is revised to read as follows: Article 401. The licensee shall be responsible for the construction and installation of steel frazil ice booms to alleviate frazil ice flooding at the Shawano Project, as follows: No later than September 1, 2006 and September 1, 2007 the licensee shall deposit \$5,000 each year into the Shawano Resource Enhancement Fund, established pursuant to article 415 of this license, to be used for the purpose of construction and installing frazil ice booms. No later than September 1, 2008, the licensee shall contribute an additional \$7,000 to the Shawano Resource Enhancement Fund for the same purpose. In the event the initial cost or replacement cost of frazil ice booms exceeds \$55,000 in the aggregate, the licensee shall contribute, in addition to the \$17,000 identified above, 50 percent of the cost above \$55,000, but not to exceed an additional \$8,000. By January 15, 2010, the licensee shall submit a plan and design for the ice booms to the Commission for approval prior to construction and installation. The Commission reserves the right to require changes to the plan. Upon Commission approval, the licensee shall commence construction and installation, including any changes required by the Commission, on or before June 1, 2010. The licensee shall consult with the Menominee Indian Tribe (Tribe) and the Bureau of Indian Affairs (BIA) annually to discuss the status of construction efforts, operation and maintenance concerns, and any other relevant issues. The Annual Accounting Report required by article 415 shall describe efforts to fulfill this license obligation during the previous year and anticipated efforts and costs for the coming year.

Article 403 of the license is revised to add the following last paragraph: No later than 30 days after the issuance date of this order, the licensee shall place in operation a website providing data from the existing downstream flow gaging station. Data from the flow gaging station shall be recorded in hourly increments, and the website updated twice daily at approximately 8:00 a.m. and 6:00 p.m. CST. The licensee shall be responsible for the continued operation and maintenance of the website for the life of the license and shall provide sufficient upgrades as necessary to accommodate changes in technology, as determined in consultation with the Tribe. The licensee shall be responsible for one-half of the monthly cost to operate and maintain the website. The licensee shall make website data available to the Tribe,

the Wisconsin Department of Natural Resources (WDNR), the BIA, the U.S. Fish and Wildlife Service (FWS), the U.S. Geological Survey (USGS), and to the Commission.

Article 408 of the license for Project No. 710 is revised to read as follows: Article 408. The licensee shall implement the terms of the fishery enhancement plan approved and modified by Commission orders dated November 30, 1999 and May 15, 2000. The purpose of this plan is to enhance the aquatic habitat and the fishery in the project impoundment. From the year of issuance of this order through and including 2006, the licensee shall contribute \$5,200 (in 2003 dollars) annually, due no later than December 31 of each year, into the bank account existing at Fifth Third Bank in Petoskey, Michigan. No later than December 31, 2007, the licensee shall contribute an additional \$2,500 to said bank as a 2007 payment to the above-mentioned bank account, after which the licensee's funding obligation will cease. Annual contributions shall be indexed according to the Consumer Price Index and are to be used for the sole purpose of funding the approved fishery enhancement plan. Funds will be subject to disbursement following consultation with the Tribe and based on agreement. The licensee shall provide the Tribe monthly bank statements reflecting activity in the account. The licensee's obligations to implement the substantive terms of the fishery enhancement plan will continue until all required mitigation set forth therein is completed. The licensee shall file with the Commission an annual report on the status and schedule of the enhancement work and the results of any studies on the effectiveness of the enhancement measures. This report shall be filed no later than March 1 of each year for the previous year's activities and until enhancement of all sites identified in the approved fishery enhancement plan is completed. The licensee shall provide the reports to the FWS, the WDNR, and the Tribe, allowing 30 days for comments, before filing the reports with the Commission. The reports shall include any letters of comment from these entities.

Article 409 of the license for Project No. 710 is revised to read as follows: Article 409. The licensee shall monitor and survey purple loosestrife on an annual basis and in accordance with the approved Purple Loosestrife Monitoring Plan, 87 FERC 62,123 (1999), until the end of 2005, after which the licensee's responsibility to monitor purple loosestrife shall cease. The final monitoring report shall be filed with the Commission no later than December 31, 2006. Commencing December 31, 2007, and through and including December 31, 2016, the licensee shall contribute \$1,500 per year to the Shawano Resource Enhancement Fund established pursuant to article 415 of this license. These funds shall be expended by the licensee, in consultation with the Tribe, for the purpose of eradicating purple loosestrife within the project boundary as approved by the Commission, 94 FERC 61,294 (2001) throughout the remainder of the license term.

The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis to discuss appropriate purple loosestrife eradication efforts. Eradication efforts should be in compliance with the approved Purple Loosestrife Monitoring Plan. The Annual Accounting Report required by article 415 of this license shall describe eradication efforts during the previous year and anticipated efforts for the coming year.

Article 414 of the license for Project No. 710 is revised to read as follows: Article 414. The licensee shall participate in the May 1995 Menominee Reservation-Lake Sturgeon Management Plan ("Plan") as follows: The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis to

discuss ongoing trap and transport operations and to assess the continuing need for such operations, and shall include a report on such consultations in the Annual Accounting Report required in article 415 of this license. Commencing September 1, 2006, the licensee shall contribute \$1,500 annually to the Shawano Resource Enhancement Fund established in article 415 of this license, to be used for the purpose of trap and transport of Lake Sturgeon in accordance with the Plan. This annual payment is due no later than June 30 of each year and shall continue until an upstream fish passage facility is installed and operational, or until the Commission determines, following consultation as set forth above, that trap and transport is no longer necessary, at which time the licensee's annual \$1,500 contribution for trap and transport of Lake Sturgeon shall cease.

The following article is added to the license for Project No. 710: Article 415. The licensee, together with the Tribe, shall establish the Shawano Resource Enhancement Fund no later than 60 days after the date of this order. The Fund shall be established for the mitigation measures set forth in articles 401, 409, 414, 416, 417, 418, and 419 as set forth in this order. If any of the payments required by these articles are not paid by the licensee within 30 days of the due date specified in each article, interest shall accrue at the rate of 6% per annum, owing on the unpaid amount from the specified due date until paid. All interest accrued in the Fund shall be applied in fulfillment of these articles on a pro rata basis after adjustment for the payment of any fees and/or taxes assessed upon the fund.

By March 1 of each year, the licensee shall file with the Commission an Annual Accounting Report that describes the activities that have been funded by the Shawano Resource Enhancement Fund in the previous year and anticipated activities and associated costs for the coming year. The report shall include proof of consultation with and any comments from the Tribe, the FWS, the BIA, and the WDNR. The licensee shall allow the Tribe and the agencies a minimum of thirty days to comment and to make recommendations before the report is filed with the Commission. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons, based on project-specific information. The report shall also include any letters of comment from the Tribe and the agencies.

The following article is added to the license for Project No. 710: Article 416. Not later than December 31, 2006, the licensee shall make a one-time payment to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used towards the installation of an upstream USGS gaging station. The amount of the payment shall be \$3,250 in the event costs for installing the upstream gaging station are \$10,000 or higher. The amount of the payment shall be 25 percent of the costs for installing the upstream gaging station if such costs are less than \$10,000. In addition, beginning on September 1, 2006, the licensee shall pay \$1,200 annually (without adjustment for inflation) to be used exclusively for annual maintenance costs for the upstream gaging station. This \$1,200 annual payment shall be deposited into the Shawano Resource Enhancement Fund and is required for the remainder of the license term. The gaging station shall be located within the Project boundary.

The following article is added to the license for Project No. 710: Article 417. The licensee shall be responsible for the installation of an upstream fish passage facility, as follows: The licensee shall contribute \$5,000 per year commencing January 1, 2008, through and including January 1, 2012, and \$10,000 per year commencing January 1, 2013, through and including January 1, 2016, to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used by the licensee for the

purpose of installing an upstream fish passage facility. The licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis starting in 2008 to discuss construction plans and designs, the target species for passage, and a schedule for fulfilling this license obligation. The licensee shall obtain the approval of the FWS and the WDNR regarding the functional and technical feasibility of the construction plans and designs prior to installing an upstream fish passage facility. Such plans and designs shall be filed with the Commission for approval no later than January 31, 2016 and must be approved by the Commission before being implemented or constructed by the licensee.

Starting in 2008, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of an upstream fish passage facility during the previous year and anticipated efforts for the coming year. Installation of an upstream fish passage facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the downstream fish protection facility requirement contained in article 418, does not exceed more than 5 percent of average annual generation.

The following article is added to the license for Project No. 710: Article 418. The licensee shall be responsible for the installation of a downstream fish protection facility, as follows: Commencing July 1, 2017 and continuing through and including July 1, 2021, the licensee shall contribute \$11,000 annually to the Shawano Resource Enhancement Fund established in Article 415 of the license, to be used by the licensee for the purpose of the study, planning and installation of a downstream fish protection facility. The licensee shall obtain the approval of the FWS and the WDNR regarding the functional and technical feasibility of the construction plans and designs prior to installing a downstream fish passage protection facility.

Starting on or before July 1, 2015, the licensee shall consult with the Tribe, the FWS, the BIA, and the WDNR on an annual basis through and including the year 2021 to discuss study plans and results, construction plans and designs, a schedule for fulfilling this license obligation and any other relevant issues. Starting in 2015, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of a downstream fish protection facility during the previous year and anticipated efforts for the coming year. Plans and designs shall be filed with the Commission for approval no later than January 31, 2021 and must be approved by the Commission before being implemented or constructed by the licensee. Installation of a downstream fish protection facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the upstream fish passage requirement contained in article 417, does not exceed more than 5 percent of average annual generation.

The following article is added to the license for Project No. 710: Article 419. Not later than January 1, 2016, the licensee shall file with the Commission, for approval, a plan for freshwater mussel restoration. The licensee shall be responsible for implementation of the plan, as follows: Commencing January 1, 2017, and continuing through and including January 1, 2026, the licensee shall contribute \$1,750 annually to the Shawano Resource Enhancement Fund established pursuant to article 415 of this license, to be used by the licensee for the purpose of freshwater mussel restoration. The licensee shall consult with the Tribe, the FWS, the BIA and the WDNR on an annual basis starting on or before January 1, 2015

and through and including the year 2026 to discuss plans and schedules for freshwater mussel restoration efforts.

The licensee shall provide the draft plan to the FWS, the WDNR and the Tribe for review, allowing 30 days for comments before filing the plan with the Commission. The plan shall include any letters of comment from these entities. The Commission reserves the right to require changes to the plan.

The following article is added to the license for Project No. 710: Article 420. Notwithstanding the limitation on expenditures included in this license, the Commission reserves the right to require the licensee to undertake such measures as may be appropriate and reasonable to implement approved plans and other requirements in this license.

Within 30 days of completion of construction of the frazil ice booms required by article 401, the licensee shall file revised exhibit F and G drawings, to incorporate these features into the project license and project boundary.

This order constitutes final agency action. Requests for rehearing by the Commission may be filed within 30 days from the date of issuance of this order, pursuant to 18 C.F.R. § 385713.

Joseph D. Morgan Director Division of Hydropower Administration and Compliance

ENVIRONMENTAL ASSESSMENT

APPLICATION FOR AMENDMENT OF LICENSE

Shawano Project FERC No. 710-038

Wisconsin



Federal Energy Regulatory Commission Office of Energy Projects
Division of Hydropower Administration and Compliance
888 First Street, N.E. Washington, D.C. 20426

August 2006

ENVIRONMENTAL ASSESSMENT

FEDERAL ENERGY REGULATORY COMMISSION OFFICE OF ENERGY PROJECTS

DIVISION OF HYDROPOWER ADMINISTRATION AND COMPLIANCE

1.0 APPLICATION: On April 27, 2006, Wolf River Hydro Limited Partnership (licensee) filed a request to amend the project license for the Shawano Project, located on the Wolf River in Shawano County, Wisconsin, and, in part, within the Menominee Indian Reservation. The licensee states that the amendment application is the result of a collaborative effort to resolve pending court appeals regarding the new license, issued on May 16, 1997.

The licensee's April 27 filing includes a Settlement Agreement (SA) between the licensee, the Menominee Indian Tribe of Wisconsin (Tribe) and the U.S. Department of the Interior (Interior), acting through the Bureau of Indian Affairs (BIA) and the U.S. Fish and Wildlife Service (FWS). In addition, the licensee states that the Wisconsin Department of Natural Resources (WDNR) concurs with the proposals. The licensee requests amendment of the license as described below and an extension of the project license term to 2037. The current license expires in 2027.

2.0 PURPOSE AND NEED FOR ACTION: The purpose of this Environmental Assessment (EA) is to analyze the environmental effects of the proposed action and provides a basis for the Commission to make an informed decision on the licensee's application. The analysis of this EA looks solely at the environmental measures proposed by the licensee, not whether the proposed funding is adequate to implement the measures. It also does not consider the licensee's request to extend the license term.

3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 Proposed Action: In the application, the licensee proposes five new license articles that would require the licensee to: (1) establish a Shawano Resource Enhancement Fund (article 415); (2) install upstream gaging (article 416); (3) construct upstream fish passage facilities (article 417); (4) construct downstream fish passage facilities (article 418); and (5) develop a plan for freshwater mussel restoration (article 419). Secondly, the licensee proposes modifications to five existing requirements of the license that regard: (1) frazil ice formation (article 401); (2) fisheries enhancement (article 408); (3) downstream gaging (article 403); (4) purple loosestrife (article 409); (5) trap and transport of Lake Sturgeon (article 414). For brevity, the exact language of the proposed license articles is not detailed here but can be found in the licensee's April 27, 2006 filing.

Within the proposed license articles, the licensee provides a schedule for depositing monies into the resource enhancement fund³ that would provide for implementation of these measures staggered over the remainder of the license term. Lastly, the licensee requests to extend the project license term ten years from April 30, 2027, to April 30, 2037.

3.1 Action Alternatives: There are no identified action alternatives for this proposal.

3.2 No-action Alternative: The no-action alternative consists of denying the licensee's application for amendment of license and denying the licensee's request for extension of the license term.

4.0 CONSULTATION: The licensee's April 27 filing includes a Settlement Agreement (SA) between the licensee, the Tribe, and Interior, acting through the BIA and the FWS. By letter dated October 20, 2005, the WDNR concurs with the licensee's proposal.

The Commission public noticed the application on May 16, 2006, with a comment period ending June 16, 2006. The DOI (on behalf of the BIA and FWS) and the Tribe filed Motion's to Intervene on June 14, and 16, 2006, respectively. In their respective filings, both DOI and the Tribe expressed support of the licensee's amendment request. On June 19, 2006, DOI filed a letter stating that it had no additional comments on the application. No other parties filed comments in response to the notice.

In addition to our public notice and pursuant to Section 106 of the Historic Preservation Act, we requested comments from the State Historical Society of Wisconsin (SHPO) by letter dated July 10, 2006. This consultation is discussed in the appropriate sections below.

5.0 AFFECTED ENVIRONMENT: The Shawano Project is located on the Wolf River in Shawano County, Wisconsin, and in part within the Menominee Indian Reservation. Project facilities lie 4.5 miles to the north-northwest of Shawano, Wisconsin (Wolf River Hydro Limited Partnership, 2006). Unless otherwise noted, the information contained in this section was based on Commission staff's Environmental Assessment (EA) prepared for the application for license, issued February 17, 1993.

5.1 Water Resources: The project's impoundment extends upstream to the village of Keshena, within the Menominee Indian Reservation (Wolf River Hydro Limited Partnership, 2006). At normal pool, the project's impoundment has a surface area of 149.6 acres and extends approximately 2.4 miles upstream of the Menominee Indian Reservation (Wolf River Hydro Limited Partnership, 2006).

In the project vicinity, the water of the Wolf River is classified as a warmwater sport fishery. It is considered acceptable for propagation of fish and other life and wild and domestic animals, domestic and recreational purposes, and agricultural, commercial, industrial and other legitimate uses. The State standard for dissolved oxygen (DO) is 5.0 milligrams per liter (mg/l) at all times, with temperatures not to exceed 89°F for warmwater fish, a pH within the range of 6-9, and substance toxicity concentrations within the Environmental Protection Agency's guidelines.

Water quality sampling in the project area in 1991 identified few violations from state standards. Based on biological sampling also conducted in 1991, waters upstream and downstream of the project dam were classified as "very good" and "good", respectively. The project operates in a run-of-river mode, as required by article 402 of the license. This is defined by article 402 as maintaining a target elevation of 818.0 feet National Geodetic Vertical Datum (NGVD) \pm 0.3 foot.

Frazil ice at times can form in the project area resulting in flooding in the village of Keshena. The Commission previously concluded that the project bears at least some responsibility for the flooding

problem. Consequently, the Commission modified article 416 to require the licensee develop a plan for control of frazil ice at the project. The plan was to include an evaluation of alternatives to alleviate the frazil ice-related problems at the project, to include the installation of ice-booms or other alternatives.

5.2 Fish and Aquatic Resources: Fish species in the project area include Walleye, Smallmouth Bass, Largemouth Bass, Northern Pike, Yellow Perch, Muskellunge, bullhead, catfish, mooneye, white bass, carp, redhorse, suckers, and panfish. The WDNR manages the Wolf River primarily for Smallmouth Bass. In addition, there is a spring spawning run of Lake Sturgeon up to the exempted Shawano Paper Mill Dam (FERC No. 8015), located 5.3 miles downstream of the project, which blocks upstream migration.

Mussel species upstream of the project dam include: the threeridge mussel, giant floater mussel, creek heelsplitter, pink heelsplitter, and the Salamander Mussel. Mussel species found downstream of the project dam, but not upstream, include the paper pondshell, snuffbox, white heelsplitter, fragil papershell, hickorynut, threehorn wartyback, mapleleaf, pimpleback, lilliput, buckhorn, and deertoe (Department of Interior, 1997). The DOI identified the snuffbox mussel and Salamander Mussel as Federal Species of Concern,⁷ as well as being state-listed species. In addition, the buckhorn mussel is a state threatened species. The health of these three species is of particular concern (Department of Interior, 1997).

5.3 Terrestrial Resources: Lands within the project boundary can be categorized as upland forest, palustrine wetlands (both forested and emergent), and lacustrine littoral and limnetic aquatic bed.

Dominant tree species include white pine, northern red oak, white oak, red maple, sugar maple, white birch, and black ash. Wild rice and the highly invasive purple loosestrife are dominant in wetland areas. As discussed in the licensee's 2001 monitoring report, purple loosestrife is relatively widespread at the project increasing in both stand area and in the number of spot occurrences compared to previous years' monitoring (Wolf River Hydro Limited Partnership, 2002).

Wildlife species that are observed in the project area include resident and migratory waterfowl, such as wood duck, mallard, merganser, blue-winged teal. Eastern painted turtle, snapping turtle, wood turtle, and garter snake are common reptiles found in the area. Amphibians include the mud puppy, American tree frog, green frog, and leopard frog. Typical mammals include beaver, muskrat, squirrels, chipmunks, and rabbits.

No species listed under the Endangered Species Act is known to occur in the project area. Bald Eagles forage along the Wolf River and may migrate through the area, but none are known to nest in the project area. Article 410 of the license required the licensee to file a plan to preserve all suitable Bald Eagle nest trees located on project lands. This plan was filed on November 13, 1997 and approved by the Commission on April 6, 1999. The licensee identified no trees suitable for Bald Eagle nesting, but if such trees develop on project lands, the licensee is responsible for maintaining and protecting those trees.

In general, lands in the project area are primarily undeveloped forest lands, agricultural lands, and rural residential properties.

5.4 Recreation Resources: Recreation activities at the project are limited and primarily include fishing, swimming, and boating. Annual visitation at the project in 1991 was estimated at 772 visitors.

Article 412 of the license originally required the licensee to make the following improvements at an existing boat access area on the west bank of the flowage: (1) pave the access road; (2) provide parking for 2-3 vehicles with trailers; and (3) install a prefabricated concrete ramp. On August 13, 2001, the licensee filed a request to delete the requirements of this article. Given that the existing area was already paved and had ample parking, article 412 was deleted from the license by Commission order issued April 30, 2002.

5.5 Cultural Resources: The project dam and powerhouse are not eligible for listing on the National Register of Historic Places. However, archaeologically and culturally significant sites are found throughout the project area including prehistoric sites, seven historic Menominee homesteads, and six other sites. Two of these sites, a historic cemetery and a mound group, are National Register eligible.

Article 411 of the license requires the licensee implement the provisions of the “Programmatic

Agreement Among the Federal Energy Regulatory Commission, the Wisconsin State Historic Preservation Office, and the Advisory Council on Historic Preservation Office, for the Management of Historic Properties that May be Affected by a License Issuing to Wisconsin Power & Light Company to Continue Operating the Shawano Hydroelectric Project (PA).”

The PA requires the licensee to develop a Cultural Resources Management Plan. It also defines the procedures to be followed in the interim until such a plan is approved by the Commission, which includes consultation with the SHPO about potential for effects to historic properties through ground disturbing activities and active erosion at the shoreline. The PA also provides guidelines for all study and report preparation, handling of archaeological data recovery, treatment of human remains and other cultural items encountered on tribal Lands of the Menominee as well as Shawano County in general, and the curation of archaeological collections, notes, maps, and other documentation. It also includes provisions for dispute resolution.

6.0 ENVIRONMENTAL IMPACTS

6.1 Water Resources: Only during the construction of upstream and downstream fish passage is a potential for adverse impacts on water quality expected. No details were provided regarding the type of facilities to be constructed or the extent of ground disturbing activities involved with construction. However, any adverse impacts resulting from construction would be temporary in nature. As proposed by the licensee, a detailed plan for these facilities would be filed with the Commission prior to construction. Review of the detailed plans at that time would allow us to identify any necessary measures to minimize any potential impacts on water quality.

Another proposed measure includes the installation of ice booms upstream of the project. Ice boom installation would minimize impacts associated with frazil ice flooding upstream of the project, benefiting those residents that are affected in Keshena. Ice boom installation is not expected to

adversely affect water quality. The proposed changes to the fisheries enhancement plan and purple loosestrife plans, and the proposals regarding gaging, trap and truck of Lake Sturgeon, and freshwater mussel restoration are not expected to result in any adverse impacts to water quality.

Gaging improvements, also proposed, would assist the licensee and the parties in determining compliance with the requirements of the license and therefore would also be beneficial.

6.2 Fish and Aquatic Resources: Many of the measures proposed by the licensee would directly benefit the aquatic resources in the project area. These measures include trap and transport of Lake Sturgeon, upstream and downstream fish passage, fisheries enhancement, and freshwater mussel restoration. Specifics are described below. No permanent adverse impacts from any of the proposed measures are expected on fish and other aquatic resources. Some displacement of individual fish may occur during construction of fish passage facilities or the installation of ice booms. This adverse effect would be temporary in nature.

Constructing fish passage facilities at the project would assist in reestablishing Lake Sturgeon upstream of the project. Since 1995, Lake Sturgeon have been transported, tagged, and released upstream of the project dam (Wolf River Hydro Limited Partnership, 2006). Some of these fish have since migrated downstream of the project. The licensee's application documented the presence of at least 10 Lake Sturgeon between the Shawano Paper Mill Dam (P-8015), downstream, and the project's dam (Wolf River Hydro Limited Partnership, 2006). Upstream passage at the project would provide these fish a safe route around the dam and access to upstream tribal lands and waters.

Article 408 originally required the licensee to develop a fishery enhancement plan for the project with an annual cost not to exceed \$4,100 (in 1993 dollars), through the term of the license. The licensee filed the plan on August 5, 1999. The plan was modified and approved by the Commission on November 30, 1999. Subsequently, the licensee filed proposed modifications to the plan on February 29, 2000, which were approved by the Commission by order issued May 15, 2000.

The approved fishery enhancement plan requires the improvement/enhancement of six sites in the project impoundment. Improvements include rip rap of the shoreline, use of half-logs in some areas, use of anchored tree drops, and enhancement of marsh areas with vegetation.

The licensee proposes to modify article 408 only to cite to the approved plan and to outline the funding that would be provided to complete work at the sites that have yet to be completed, Sites 1 and 2. Only beneficial effects are expected from completing the required enhancement projects outlined in the approved plan.

The licensee proposes to develop, in consultation with the Tribe, FWS, and the WDNR, a plan for freshwater mussel restoration. The plan would be developed by January 2016. In its application, the licensee states that the types of activities that would be implemented might include population monitoring, habitat assessment and possible relocation of mussel species to the area. Population monitoring and habitat assessments would identify areas where mussel species are most abundant in the project area, or most likely to occur. Active reseeding of individuals in the area may improve the

likelihood of the development of self-sustaining populations. Providing fish passage at the project may also indirectly benefit the mussel species in the area, by allowing movement of host fish throughout the project area.

6.3 Terrestrial Resources: Regarding terrestrial resources, the licensee proposes changes to article 409 of the license, which required the development of a plan to monitor purple loosestrife within the project boundary. This plan was filed on November 13, 1997, and approved by the Commission on May 3, 1999. In part, the approved plan requires the licensee to survey for purple loosestrife between July 15 and September 1 of each year, documenting the dominant and spot occurrences on maps, and physically removing any purple loosestrife found. Further, the licensee is required to submit annual reports to the WDNR and FWS by December 31 of each year regarding the monitoring, and file them with the Commission, along with any agency comments.

The licensee's proposed changes involve eliminating monitoring after 2006, but continuing efforts to eradicate the species through 2016. Annual reports filed with the Commission through 2016 would document the licensee's success in this regard. The licensee speculates that after 2016, biocontrol efforts may eradicate the species from the project area.

Continued eradication efforts, as proposed by the licensee, would benefit native plants in the area, and hopefully control the spread of this invasive species. While we would like to agree with the licensee that biocontrol efforts may effectively eliminate the species from the project area by 2016, there is no guarantee that this would occur.

6.4 Recreation Resources: Recreation at the project is extremely limited. No measures that the licensee has proposed directly involve recreation. Only during construction of fish passage facilities would there exist a potential for adverse impacts on recreational fishing or boating. This impact is expected to be minimal, if any. In sum, little to no impact on recreation resources is expected under the licensee's proposal.

6.5 Cultural Resources: Culturally significant resources are many in and near the project area, particularly on tribal lands. One aspect of the licensee's proposed amendment application involves the installation of ice booms in efforts to minimize frazil ice related flooding on tribal lands. No detail was provided on the location of installation, or what storage of the booms would entail. The licensee only states that the proposed location of the ice booms is on lands held in trust by the United States for the benefit of the Tribe.

Similar to its approach to fish passage, the licensee proposes to file with the Commission, for approval, a detailed plan prior to construction and installation of the ice booms. Ice booms installation would occur no later than June 1, 2010. A detailed plan would be filed prior to this date, which will allow for Commission review at that time. We expect that the plan will provide for the licensee to work with the Tribe in determining the exact location for the ice boom installation and storage, and that such collaboration will result in the avoidance of areas of cultural significance. We agree with this approach.

By letter dated July 10, 2006, we requested concurrence from the SHPO that based on the information

contained in the licensee's application, there would be no effect on historic or culturally significant properties resulting from the licensee's proposal. No comments were received. Consultation under section 106 of the Historic Preservation Act is complete.

As required, the licensee would continue to abide by the conditions outlined in the PA. Thus, we expect that all historic and culturally significant properties in the area will be protected.

7.0 SECONDARY AND CUMULATIVE EFFECTS: Secondary impacts are those that are indirectly caused by or result from an activity and are reasonably foreseeable. They may occur later in time than the activity and be removed in terms of distance.

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act, an action may cause cumulative impacts on the environment if its impacts overlap in space and/or time with the impacts of the other past, present, or reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions.

We have identified no secondary and cumulative impacts associated with the licensee's proposal.

8.0 NO-ACTION ALTERNATIVE: Under the No-Action alternative, the environmental measures proposed by the licensee would not be made part of the license.

9.0 CONCLUSION AND RECOMMENDATIONS: The licensee's proposed measures include: (1) the installation of ice booms upstream of the project; (2) completion of the two fishery enhancement sites that have yet to be completed; (3) eradication of purple loosestrife through 2016; (3) establishment of a website for the downstream gage available to the Tribe, WDNR, the BIA, the FWS, the USGS, and the Commission; (4) establishment of an upstream gaging station; (5) participation in trap and transport of Lake Sturgeon; (6) installation of upstream fish passage facilities; (7) installation of downstream fish passage; and (8) a plan for freshwater mussel restoration. In general, these measures are beneficial in nature, improving habitat for fish and mussels in the project area, as well as assisting the various parties in determining compliance through improvements to gaging. Installation of frazil ice booms should minimize frazil ice related flooding in Keshena, also a benefit.

In our review of the proposed action, we did not identify any significant impacts to the human environment should the Commission amend the license for the project as proposed. Only during construction of some of the proposed fish passage facilities might there be temporary impacts to water quality, aquatic resources, and recreation at the project. The magnitude of such an impact is unknown at this time, since no details were provided in the application regarding the type of facilities to be constructed. Conceptual plans would be filed with the Commission closer to the timing of facility installation that would allow for more in-depth review by Commission staff. We note here that installation of fish passage would likely require revisions to the approved exhibit drawings. Given the length of time that would pass prior to facility installation, we consider it best to require revised exhibit drawings, if needed, at the time of Commission staff's review of these detailed plans.

Similarly, a detailed plan for the ice boom installation would be filed for Commission approval.

According to the licensee's schedule, the filing of such a plan would occur sometime before June 1, 2010. In the application before us, the licensee only notes that the current proposed location for the ice booms is on tribal lands.

Approving this measure would mean that installation of the booms would be required and made part of the license. Thus, the booms would become project features. Given this fact and the schedule for installation in the near future, i.e., before 2010, the booms and the lands on which they are installed must be included within the project boundary, in accordance with standard Article 5 of the license. As such, we recommend requiring the licensee file revised exhibits F and G.

Although the licensee's proposed license articles 417 and 418 require the installation of upstream and downstream fish passage facilities, respectively, the language of the SA indicates that it has not yet been determined that installation of these facilities is feasible at the project. Ultimately, if upstream fish passage is considered infeasible, the funds for upstream fish passage would be used for continued support of trap and truck operations. Only beneficial effects are expected from installation of upstream and downstream fish passage facilities and continued support of trap and truck of Lake Sturgeon. With adoption of the licensee's proposed language (as new articles 417 and 418), actual facility construction would be required by the license. In the event that fish passage facilities are considered infeasible, the licensee would need to file an application to amend the license to remove these requirements.

The proposed modifications to article 409 would effectively require eradication of purple loosestrife at the project through 2016. We noted in Section 6.3 of this EA, that purple loosestrife is relatively widespread at the project and it may still be present at the project in 2016. Eradication efforts may be necessary after that time. We therefore recommend, modifying article 409 to require continued efforts beyond 2016 to eradicate purple loosestrife. Based on evidence presented in the annual reports proposed to be filed pursuant to article 415, the licensee may request the Commission eliminate this requirement at a later date.

Approval of the licensee's application, with the proposed environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment and is in the public interest.

10.0 LITERATURE USED

Department of Interior. 1997. Conditions Filed Pursuant to Section 4(e) of the Federal Power Act. Filed on June 16, 1997. p. 31.

Federal Energy Regulatory Commission (FERC). 1993. Environmental Assessment for the Shawano Hydroelectric Project, issued February 17, 1993.

FERC. 2001. Order on Rehearing and Complaint, Approving Revised Exhibit G, and Setting Matter for Hearing, issued on March 15, 2001 (94 FERC ¶ 61,294). p. 12

Wolf River Hydro Limited Partnership. 2006. Application to Amend License and Request for Expedited Treatment.

Wolf River Hydro Limited Partnership. 2002. 2001 Report on Monitoring for Purple Loosestrife, filed on April 1, 2002.

11.0 PREPARED BY, Diana Shannon, Aquatic Ecologist

DRAFT

Appendix C: 2006 Settlement Agreement

AGREEMENT TO AMEND LICENSE TERMS

This Agreement to Amend License Terms ("Settlement Agreement") is made and entered into between Wolf River Hydro Limited Partnership ("Wolf River"), the Menominee Indian Tribe of Wisconsin ("Menominee Indian Tribe") and the United States Department of the Interior, acting through the Bureau of Indian Affairs and the U.S. Fish and Wildlife Service (collectively the "Parties")

RECITALS

- A. Wolf River currently owns and operates the Shawano Hydroelectric Project, FERC Project No. 710 ("Project"), located on the Wolf River in Menominee and Shawano Counties, Wisconsin.
- B. The impoundment for the Project extends upstream approximately four miles to the village of Keshena, within the Menominee Indian Reservation. The approximate area of the impoundment that occupies Reservation lands is 71 acres.
- C. On May 16, 1997, the Federal Energy Regulatory Commission ("FERC" or "Commission") issued a new 30-year license to Wisconsin Power and Light Company for the Project. The Project license was transferred from Wisconsin Power and Light Company to Wolf River, effective June 1, 2000.
- D. The Commission's licensing order did not incorporate the Department of the Interior's conditions, submitted pursuant to section 4(e) of the Federal Power Act, for the protection and utilization of the Menominee Indian Reservation. The Menominee Indian Tribe and the Department therefore timely petitioned for court review of the Commission's licensing order in the United States Court of Appeals for the District of Columbia Circuit. That Appeal is pending in the court as Case No. 01-1205, consolidated with No. 01-1210 ("Appeal"). Wolf River intervened in the Appeal.
- E. Through mediation, the Parties have negotiated and agreed upon an appropriate set of conditions for inclusion in the Project license. The Parties have developed a set of mitigation measures that will reduce uncertainty to the licensee while also providing appropriate protection for tribal lands and resources.
- F. The Parties recognize the need to resolve expeditiously the current uncertainty regarding the extent of Wolf River's obligations in the Project license and wish to settle all of the issues now pending in the Appeal.

The Parties agree that resolution of the issues pending in the Appeal will be addressed through the

terms of this Settlement Agreement, the Application to Amend License Terms that the Parties have agreed to file jointly with the Commission, and incorporation of the license conditions proposed as numbered license articles in an amended license for the Project.

In consideration of the premises and agreements set forth herein, and other good and valuable consideration, the Parties agree as follows:

TERMS OF AGREEMENT: Application to Amend License Terms

Within 45 days of the execution of this Settlement Agreement by all Parties, Wolf River, the Menominee Indian Tribe and the Department will submit a joint Application to Amend License Terms and Request for Expedited Treatment ("Application") to the Commission requesting to amend the Project license. The Application shall be substantially in the form of Attachment A to this Settlement Agreement and shall propose in the form of license articles the agreements set forth herein.

Suspension and Dismissal of Appeals

- A. The Parties shall jointly request that the Appeal continue to be held in abeyance pending actions in furtherance of this Settlement Agreement. The Parties agree to cooperate in any necessary court filings by the Menominee Indian Tribe to continue the period of abeyance.
- B. No later than 20 days after an initial FERC order or order on rehearing approving the Application *without modification or condition* becomes final and non-appealable ("Amendment Effective Date"), the Parties will join in a stipulation of dismissal of the Appeal with prejudice. The Parties will jointly solicit FERC to join in the stipulation. Once Wolf River, the Menominee Indian Tribe, the Department and FERC have joined in the stipulation of dismissal, counsel for the Menominee Indian Tribe will file the stipulation with the court.

Upon issuance of an initial FERC order or order on rehearing approving the Application *with modifications or conditions*, each party shall, within 15 days, advise the others whether FERC's modifications or conditions are acceptable:

- 1. If the Parties agree within 20 days after issuance of the FERC order that such modifications or conditions are acceptable, Wolf River shall accept the license amendments, including FERC's modifications or conditions. Within 10 days after the date the order containing modifications or conditions becomes final and non-appealable, the Parties will join in a stipulation of dismissal of the Appeal with prejudice. The Parties will jointly solicit FERC to join in the stipulation. Once Wolf River, the Menominee Indian Tribe, the Department, and FERC have joined in the stipulation of dismissal, counsel for the Menominee Indian Tribe will file the stipulation with the court.
- 2. If, within 20 days after issuance of the FERC order, any of the Parties does not agree that such modifications or conditions are acceptable, Wolf River will not accept the amendments as modified or conditioned and the Parties, individually and jointly, will promptly assess whether to seek

rehearing. If no Party seeks rehearing, this Agreement will terminate when the FERC order becomes final and non-appealable. Should one or more of the Parties timely seek rehearing of the FERC order, the terms of this Settlement Agreement will be suspended. In accordance with 18 C.F.R. § 385.713(e), however, Wolf River will be obligated to comply with all terms of the issued license as amended by the FERC order, unless a stay is obtained from FERC. Should one or more of the Parties seek a stay of the FERC order, the other Parties agree not to oppose the request for stay.

- D. Upon issuance of an initial FERC order or order on rehearing denying the Application, the Parties will promptly and jointly assess whether to seek rehearing. If the Parties do not agree to seek rehearing, this Agreement will terminate on the date the FERC order denying the Application becomes final and non-appealable. If the Parties agree to seek rehearing and the petition is denied, this Agreement will terminate on the date that the FERC order denying rehearing on the Application becomes final and non-appealable, unless one or more of the Parties seeks timely court review of the FERC amendment order and any orders on rehearing. Should one or more of the Parties timely seek court review of the FERC order, the terms of this Settlement Agreement will be suspended. In accordance with 16 U.S.C. § 825/(c), however, Wolf River will be obligated to comply with all terms of the issued license as amended by the FERC order, unless a stay is obtained from the Court of Appeals. Should one or more of the Parties seek a stay of the FERC order in the Court of Appeals, the other Parties agree not to oppose the request for stay.
- E. If a FERC order approving the Application without modification or condition (or with modifications or conditions acceptable to the Parties) does not become final and non-appealable by January 31, 2006, the Parties will, within 15 days thereafter, meet, by conference call, to reevaluate this Agreement:
1. Any Party that intends to withdraw from this Agreement shall so notify the other Parties within 30 days after the meeting. The Parties will jointly withdraw the Application within 30 days after receiving such notice. This Agreement shall terminate as of the date of such withdrawal.
 2. If, after meeting, the Parties agree to extend this Agreement, they will jointly determine the date to which the Agreement will be extended and will leave the Application pending.
 3. Thereafter, any Party may call for a meeting to reevaluate this Agreement by giving 30 days' notice to each of the other Parties. Any Party that intends to withdraw from this Agreement shall so notify the other Parties within 30 days after the meeting. The Parties will jointly withdraw the Application within 30 days after receiving such notice. This Agreement shall terminate as of the date of such withdrawal.
- F. In the event that FERC issues an order amending the License term for any period less than 40 years and subsequently denies rehearing with respect thereto, the Parties agree that this

Settlement Agreement shall be deemed void *ab initio*.

FERC Adoption and Enforcement

The Parties have entered into this Settlement Agreement with the express expectation and condition that FERC will approve the Application and issue an order amending the Project license to incorporate the proposed license articles set forth therein and to extend the current 30-year license term to a term of 40 years, to expire May 16, 2037. The Parties agree that if FERC approves the Application and incorporates the proposed license articles into the license without modification, they will not seek rehearing of the FERC order amending the license for any issues covered by this Settlement Agreement, or support a request for rehearing by any non-- Party to this Settlement Agreement.

The Parties intend that the proposed license articles set forth in this Settlement Agreement shall be enforced by FERC as license articles. The Application shall therefore request that FERC incorporate all proposed license articles, without modification, into an amended license for the Project and to identify all proposed license Articles, if any that are unenforceable by FERC. The Parties acknowledge that all terms of this Settlement Agreement that are outside FERC's enforcement jurisdiction will not be incorporated into the amended license for the Project.

Dispute Resolution

If a dispute arises under this Settlement Agreement, the Parties shall first seek to resolve the dispute by negotiating promptly in good faith. If the Parties are unable to resolve the dispute within 60 days (or other period as may be agreed on by the Parties) following the date one Party provides written notice of the dispute, the Parties may employ the services of a mutually acceptable mediator. The Party or Parties seeking to mediate the dispute shall arrange to retain the mediator. The use of mediation will not be construed under the doctrine of laches, waiver or estoppel to affect adversely the rights of any Party and any mediation discussions shall be deemed confidential settlement discussions, and inadmissible in subsequent proceedings. If the Parties are not able to resolve the dispute within 90 days of the commencement of mediation, the Parties may pursue any available remedy. Prior to the termination of mediation, a Party shall be entitled to take any legal action necessary to preserve or retain such remedy in the event the dispute is not resolved through mediation.

Terms of Settlement

The Parties agree that FERC's approval of the Application and incorporation of the proposed license articles into the license will resolve all issues among the Parties associated with the Appeal. Pursuant to the Parties' authorities or obligations under Sections 4(e) and 18 of the Federal Power Act, this Settlement Agreement establishes the licensee's obligations for the protection, mitigation and enhancement of resources within the Menominee Reservation affected by the Project for the term of the current license, which the Application requests to be extended through May 16, 2037. Provided

the licensee complies with the terms of its license as amended pursuant to this Settlement Agreement, the Department of the Interior agrees not to exercise the authority to prescribe fishways under Article 407 of the Project license and Section 18 of the FPA or to otherwise propose additional license provisions, unless required to do so by a material change in law or environmental circumstances. The Parties agree to consult prior to the exercise of any such authority. The Parties further agree to jointly petition FERC to modify those license articles imposing an affirmative duty on the licensee to make payments into the Shawano Resource Enhancement Fund such that the annual funding obligation would not be exceeded by more than five percent.

Specific License Terms

A. Establishment of Shawano Resource Enhancement Fund.

1. The Parties shall include in the Application to be filed with FERC, a request that the Project license be amended to include the following new license Article 415:

The licensee, together with the Menominee Indian Tribe of Wisconsin, shall establish the Shawano Resource Enhancement Fund no later than 60 days after the date of this order. The Fund shall be established as an interest-bearing escrow account to be used exclusively for the mitigation measures set forth in Articles 401, 409, 414 and new Articles 416, 417, 418 and 419 as set forth in this order. If any of the payments required are not paid within 30 days of the due date specified in each Article, interest shall accrue at the rate of 6% per annum, owing on the unpaid amount from the specified due date until paid. All interest accrued in the Fund shall be applied in fulfillment of these Articles on a pro rata basis after adjustment for the payment of any fees and/or taxes assessed upon the fund.

By March 1 of each year, the licensee shall file with the Commission an Annual Accounting Report that describes the activities that have been funded by the Shawano Resource Enhancement Fund in the previous year and anticipated activities and associated costs for the coming year. The report shall include proof of consultation with and any comments from the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs and the Wisconsin Department of Natural Resources. The licensee shall allow the Tribe and the agencies a minimum of thirty days to comment and to make recommendations before the report is filed with the Commission. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons, based on project-specific information. The report shall also include any letters of comment from the Tribe and the agencies.

2. The Shawano Resource Enhancement Fund shall be established in accordance with the provisions of the Escrow Agreement between Wolf River and the Menominee Indian Tribe, executed contemporaneously with this Settlement Agreement and attached hereto as Attachment B.

3. Unless agreed to otherwise by the Parties, interest accrued in the Shawano Resource Enhancement Fund shall be applied to the requirements of paragraphs VI.B.I, VI.D.I, VI.F.I, VI.G.I, VI.H.I, VI.I.I and VI.J.I on a pro-rata basis.
4. Funds, including interest thereon, in excess of amounts needed to satisfy each individual license obligation shall remain in the Shawano Resource Enhancement Fund and maybe expended to fulfill any of the other obligations set forth in paragraphs VI.B.I, VI.D.I, VI.F.I, VI.G.I, VI.H.I, VI.I.I and VI.J.I. Funds, including interest thereon, remaining after all such obligations are fulfilled or the end of the license term, whichever comes first, shall be returned to Wolf River pursuant to the disbursement instructions set forth in the Escrow Agreement.
5. Following consultation with the Menominee Indian Tribe and based on mutual agreement and consent, which shall not be unreasonably withheld, Wolf River may be reimbursed by the Shawano Resource Enhancement Fund, in amounts not to exceed prevailing rates in the local Project area, for reasonable costs that it incurs for construction, installation, permitting and similar activities required by this Settlement Agreement. Costs related to proceedings before FERC or consultation with federal, state or tribal agencies are not reimbursable. Costs shall be documented by Wolf River and submitted at least every six months to the Menominee Indian Tribe.

Control of Frazil Ice

6. The Parties shall include in the Application to be filed with FERC, a request that Article 401 of the Project license be amended as follows (existing language is deleted entirely):

The licensee shall be responsible for the construction and installation of steel frazil ice booms to alleviate frazil ice flooding at the Shawano Project, as follows: No later than July 1, 2006 and July 1, 2007, the licensee shall deposit \$5,000 each year into the Shawano Resource Enhancement Fund, established pursuant to Article 415 of this license, to be used for the purpose of constructing and installing frazil ice booms. No later than July 1, 2008, the licensee shall contribute an additional \$7,000 to the Shawano Resource Enhancement Fund for the same purpose. In the event the initial cost or replacement cost of frazil ice booms exceeds \$55,000 in the aggregate, the licensee shall contribute, in addition to the \$17,000 identified above, 50 percent of the cost above \$55,000, but not to exceed an additional \$8,000. The licensee shall submit the plan and design to the Commission for approval and the Commission must approve such plan and design prior to construction and implementation. The Commission reserves the right to require changes to the plan; Upon Commission approval, the licensee shall commence construction and installation, including any changes required by the Commission, on or before June 1, 2010. The licensee shall consult with the Menominee Indian Tribe and the Bureau of Indian Affairs annually to discuss the status of construction efforts, operation and maintenance concerns, and any other relevant issues. The Annual Accounting Report required by Article 415 shall describe efforts to fulfill this license obligation

during the previous year and anticipated efforts and costs for the coming year.

7. In addition to the amounts set forth in paragraph VI.B.I, to be provided by the licensee, limited to the aggregate amount of \$25,000, the Menominee Indian Tribe will provide the additional funding necessary to construct and install the frazil ice booms no later than by July 1, 2009.

8. Pending expenditure for the frazil ice booms, the funds contributed by Wolf River pursuant to paragraph VI.B.I shall be held in the Shawano Resource Enhancement Fund in accordance with the provisions set forth in paragraph VI.A.

9. The Menominee Indian Tribe shall be responsible for the annual installation, removal, storage, repair and maintenance of the ice booms.

10. Following consultation with the Menominee Indian Tribe and based upon mutual agreement and consent, which shall not be unreasonably withheld, Wolf River shall have the option of being the entity to conduct actual installation of the ice booms as set forth herein, with reimbursement by the Shawano Resource Enhancement Fund in accordance with paragraph VI.A.5.

Fisheries Enhancement

The Parties shall include in the Application to be filed with FERC, a request that Article 408 of the Project license be amended as follows (existing language is deleted entirely):

The licensee shall implement the terms of the fishery enhancement plan approved and modified by Commission orders dated November 30, 1999 and May 15, 2000. The purpose of this plan is to enhance the aquatic habitat and the fishery in the project impoundment. From the year of issuance of this order through and including 2006, the licensee shall contribute \$5,200 (in 2003 dollars) annually, due no later than December 31 of each year, into the bank account existing at Fifth Third Bank in Petoskey, Michigan. No later than December 31, 2007, the licensee shall contribute an additional \$2,500 to said bank as the 2007 payment to the above-mentioned bank account, after which the licensee's funding obligation will cease. Annual contributions shall be indexed according to the Consumer Price Index and are to be used for the sole purpose of funding the approved fishery enhancement plan. Funds will be subject to disbursement following consultation with the Menominee Indian Tribe of Wisconsin and based on mutual agreement. The licensee shall provide the Menominee Indian Tribe of Wisconsin monthly with bank statements reflecting activity in the account. The licensee's obligations to implement the substantive terms of the fishery enhancement plan will continue until all required mitigation set forth therein is completed.

The licensee shall meet with the Commission an annual report on the status and schedule of the enhancement work and the results of any studies on the effectiveness of the enhancement measures. This report shall be filed no later than March 1 of each year for the previous year's activities and until enhancement of all sites identified in the approved fishery enhancement plan is

completed. The licensee shall provide the reports to the U.S. Fish and Wildlife Service, Wisconsin Department of Natural Resources and the Menominee Indian Tribe for review, allowing 30 days for comments, before filing the reports with the Commission. The reports shall include any letters of comment from these entities.

B. Purple Loosestrife Removal

1. The Parties shall include in the Application to be filed with FERC, a request that Article 409 of the Project license be amended as follows (existing language is deleted entirely): The licensee shall monitor and survey purple loosestrife on an annual basis and in accordance with the approved Purple Loosestrife Monitoring Plan, 87 FERC 62,123 (1999), until the end of 2005, after which the licensee's responsibility to monitor purple loosestrife shall cease. The formal monitoring report shall be filed with the Commission no later than December 31, 2006. Commencing December 31, 2007, and through and including December 31, 2016, the licensee shall contribute \$1,500 per year to the Shawano Resource Enhancement Fund established pursuant to Article 415 of this license. These funds shall be expended by the licensee, at the direction of the Menominee Indian Tribe of Wisconsin, for the purpose of eradicating purple loosestrife within the Project Boundary as approved by the Commission, 94 FERC 61,294 (2001). The licensee shall consult with the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources on an annual basis through and including the year 2016 to discuss appropriate purple loosestrife eradication efforts. Eradication efforts should be in compliance with the approved Purple Loosestrife Monitoring Plan. The Annual Accounting Report required by Article 415 of this license shall describe eradication efforts during the previous year and anticipated efforts for the coming year.

2. Pending expenditure for purple loosestrife eradication, the funds contributed by Wolf River pursuant to paragraph VI.D.1 shall be held in the Shawano Resource Enhancement Fund in accordance with the provisions set forth in paragraph VI.A.

3. For the year 2006, the Menominee Indian Tribe will undertake efforts to eradicate purple loosestrife within the Project boundary. During the first quarter of 2008, the Tribe will be reimbursed up to the amount of \$1500 for such efforts from the Shawano Resource Enhancement Fund.

Downstream Flow Gaging Station

The Parties shall include in the Application to be filed with FERC, a request that Article 403 of the Project license be amended to include the following:

No later than 30 days after the issuance date of this order, the licensee shall place in operation a website providing data from the existing downstream flow gaging station. Data from the flow gaging

station shall be recorded in hourly increments, and the website updated twice daily at approximately 8:00a.m. and 6:00p.m. CST. The licensee shall be responsible for the continued operation and maintenance of the website for the life of the license and shall provide sufficient upgrades as necessary to accommodate changes in technology, as determined in consultation with the Menominee Indian Tribe. The licensee shall be responsible for one-half of the monthly cost to operate and maintain the website, with the Menominee Indian Tribe responsible for the remaining half of the monthly cost to operate and maintain the website. The licensee shall make website data available to the Menominee Indian Tribe of Wisconsin, the Wisconsin Department of Natural Resources, the Bureau of Indian Affairs, the U.S. Fish and Wildlife Service, the U.S. Geological Survey and the Commission.

4. The Menominee Indian Tribe agrees to pay one-half of the start-up costs for the website to provide data from the downstream flow gaging station. The Menominee Indian Tribe further agrees to pay one-half of the monthly cost to operate and maintain the website. The Menominee Indian Tribe's obligations under this paragraph shall be limited to one-half share of costs associated with phone charges at the gaging station, phone charges from Canada to retrieve data and ongoing technical support and shall not include costs associated with the operation and maintenance of the gaging station itself such as repair, maintenance or replacement of component hardware within the gaging station.

Installation and Operation of Upstream Flow Gaging Station

The Parties shall include in the Application to be filed with FERC, a request that the Project license be amended to include the following new license Article 416:

Not later than December 31, 2006, the licensee shall make a one-time payment to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used towards the installation of an upstream USGS gaging station. The amount of the payment shall be \$3,250 in the event costs for installing the upstream gaging station are \$10,000 or higher. The amount of the payment shall be 25 percent of the costs for installing the upstream gaging station if such costs are less than \$10,000.

In addition, beginning on September 1, 2006, the licensee shall pay \$1,200 annually (without adjustment for inflation) to be used exclusively for annual maintenance costs for the upstream gaging station. This \$1,200 annual payment shall be deposited into the Shawano Resource Enhancement Fund and is required for the remainder of the license term. The gaging station shall be located within the Project boundary.

5. The Menominee Indian Tribe will be responsible for seeking the necessary remaining funding for installing an upstream gaging station and will use best efforts to seek an appropriate cost-sharing arrangement with the United States Geological Survey ("USGS"). Wolf River's obligations in

connection with the upstream gaging station shall be limited to the funding obligation set forth in paragraph VI.P.1.

6. The Menominee Indian Tribe and Wolf River shall consult on a periodic basis, as appropriate to discuss the status of efforts to secure a cost-sharing arrangement with USGS, as well as projected costs and any plan and schedule for installation. The Menominee Indian Tribe shall provide Wolf River with appropriate documentation in support of projected installation costs.

Trap and Transport of Lake Sturgeon

The Parties shall include in the application to amend to be filed with FERC, a request that Article 414 of the Project license be amended as follows (existing language is deleted entirely):

The licensee shall participate in the May 1995 Menominee Reservation - Lake Sturgeon Management Plan ("Plan"), as follows: The licensee shall consult with the Menominee Indian Tribe, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources on an annual basis to discuss ongoing trap and transport operations and to assess the continuing need for such operations, and shall include a report on such consultations in the Annual Accounting Report required in Article 415 of this license. Commencing June 30, 2006, the licensee shall contribute \$1,500 annually to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used for the purpose of trap and transport of Lake Sturgeon in accordance with the Plan. This annual payment is due no later than June 30 of each year and shall continue until an upstream fish passage facility is installed and operational, or until the Commission determines following consultation as set forth above, that trap and transport is no longer necessary, at which time the licensee's annual \$1,500 contribution for trap and transport of Lake Sturgeon shall cease.

C. Installation of Upstream Fish Passage

1. The Parties shall include in the application to amend to be filed with FERC, a request that the Project license be amended to include the following new license Article 417:

The licensee shall be responsible for the installation of an upstream fish passage facility, as follows: The licensee shall contribute \$5,000 per year commencing January 1, 2008, through and including January 1, 2012, and \$10,000 per year commencing January 1, 2013, through and including January 1, 2016, to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used by the licensee for the purpose of installing an upstream fish passage facility. The licensee shall consult with the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources on an annual basis starting in 2008 to discuss construction plans and designs, the target species for passage, and a schedule for fulfilling this license obligation. The licensee shall obtain the approval of the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources regarding the functional and technical

feasibility of the construction plans and designs prior to installing an upstream fish passage facility. Such plans and designs shall also be submitted to the Commission for approval and must be approved by the Commission before being implemented or constructed by the licensee.

Starting in 2008, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of an upstream fish passage facility during the previous year and anticipated efforts for the coming year. Installation of an upstream fish passage facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the downstream fish protection facility requirement contained in Article 418, does not exceed more than 5 percent of average annual generation.

2. The Menominee Indian Tribe assumes the responsibility to seek funding in addition to the amounts set forth in paragraph VI.H.1 as may be required to install the upstream fish passage facility. On or before January 1, 2017, the Menominee Indian Tribe shall have secured the necessary funding to install the upstream fish passage facility. If such funding is not available, then the amounts set forth in paragraph VI.H.1, and any interest earned thereon shall be drawn upon to continue funding of the trap and transport program as provided for in paragraph VI.G. In such a case, so long as the licensee has funded fully its obligations under paragraph

VI.H.1 by January 1, 2016, the licensee shall not be required to make any additional payments for installation of the upstream fish passage facility set forth in said paragraph. Such funds to support trap and transport operations shall remain in the Shawano Resource Enhancement Fund for use on an annual basis. No later than June 30, 2020, the Menominee Indian Tribe of Wisconsin, the U.S. Fish & Wildlife Service, the Bureau of Indian Affairs, the Wisconsin Department of Natural Resources and the Licensee shall determine in consultation whether construction and installation of an upstream fish passage facility is biologically, technically and economically feasible. If the Menominee Indian Tribe of Wisconsin, the U.S. Fish & Wildlife Service, the Bureau of Indian Affairs, the Wisconsin Department of Natural Resources and the Licensee determine in consultation, and with Commission approval, that construction and installation of an upstream fish passage facility is not biologically, technically or economically feasible, remaining funds in excess of those needed to fund trap and transport operations, as provided for in paragraph VI.G., shall be returned to the licensee.

3. For purposes of this proposed new license article, installation of an upstream fish passage facility includes planning and design, engineering, construction, and clean-up. All costs for such activities shall be borne by the Shawano Resource Enhancement Fund established pursuant to paragraph VI.A.1.

4. Once the licensee has installed the upstream fish passage facility, the Menominee Indian Tribe shall be responsible for its annual operation and maintenance.

5. Following consultation with the Menominee Indian Tribe, U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources, and based upon mutual agreement and consent, which shall not be unreasonably withheld, Wolf River shall have the option of being the entity that conducts actual installation of the upstream fish passage facility, with reimbursement by the Shawano Resource Enhancement Fund in accordance with paragraph VI.A.5.

6. Pending expenditure for the upstream fish passage facility, the funds contributed by Wolf River pursuant to paragraph VI.H.1 shall be held in the Shawano Resource Enhancement Fund in accordance with the provisions set forth in paragraph VI.A.

Installation of Downstream Fish Protection Facility

The Parties shall include in the application to amend to be filed with FERC, a request that the Project license be amended to include the following new license Article 418:

The licensee shall be responsible for the installation of downstream fish protection facility, as follows: Commencing July 1, 2017 and continuing through and including July 1, 2021, the licensee shall contribute \$11,000 annually to the Shawano Resource Enhancement Fund established in Article 415 of this license, to be used by the licensee for the purpose of the study, planning and installation of a downstream fish protection facility. The licensee shall obtain the approval of the U.S. Fish and Wildlife Service and the Wisconsin Department of Natural Resources regarding the functional and technical feasibility of the construction plans and designs prior to installing a downstream fish protection facility.

Starting on or before July 1, 2015, the licensee shall consult with the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources on an annual basis through and including the year 2021 to discuss study plans and results, construction plans and designs, a schedule for fulfilling this license obligation and any other relevant issues. Starting in 2015, the Annual Accounting Report required by Article 415 of this license shall describe the results of consultation, efforts towards installation of a downstream fish protection facility during the previous year and anticipated efforts for the coming year. Any plans and designs shall also be submitted to the Commission for approval and must be approved by the Commission before being implemented or constructed by the licensee. Installation of a downstream fish protection facility shall be conditioned on design criteria indicating that total reduction in generation from this requirement, when combined with any reduction relating to the upstream fish passage requirement contained in Article 417, does not exceed more than 5 percent of average annual generation.

The Menominee Indian Tribe assumes the responsibility to seek funding in addition to the amounts set forth in paragraph VI.I.1 as may be required to install the downstream fish protection facility. On

or before July 1, 2022, the Menominee Indian Tribe shall have secured the necessary funding to install the downstream fish protection facility. If such funding is not available, then the amounts set forth in paragraph VI.I.1, and any interest earned thereon shall be drawn upon to continue funding of the trap and transport program as provided for in paragraph VI.G. In such a case, so long as the licensee has funded fully its obligations under paragraph VI.I.1 by July 1, 2021, the licensee shall not be required to make any additional payments for installation of the downstream fish protection facility set forth in said paragraph. Such funds to support trap and transport operations shall remain in the Shawano Resource Enhancement Fund for use on an annual basis. No later than June 30, 2024, the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, the Wisconsin Department of Natural Resources and the Licensee shall determine in consultation whether construction and installation of a downstream fish protection facility is biologically, technically and economically feasible. If the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, the Wisconsin Department of Natural Resources and the Licensee determine in consultation, and with Commission approval, that construction and installation of a downstream fish protection facility is not biologically, technically or economically feasible, remaining funds in excess of those needed to fund trap and transport operations, as provided for in paragraph VI.G., shall be returned to the licensee.

3. For purposes of this proposed new license article, installation of a downstream fish protection facility includes planning and design, engineering, construction, and clean-up. All costs for such activities shall be borne by the Shawano Resource Enhancement Fund established pursuant to paragraph VI.A.I.

4. Once the licensee installs the downstream fish protection facility, the Menominee Indian Tribe shall be responsible for any additional labor costs incurred over that already being paid for operation and maintenance of the Project.

5. Pending expenditure for the downstream fish passage facility, the funds contributed by Wolf River pursuant to paragraph VI.I.I shall be held in the Shawano Resource Enhancement Fund in accordance with the provisions set forth in paragraph VI.A.

J. Freshwater Mussel Restoration

1. The Parties shall include in the application to amend to be filed with FERC, a request that the Project license be amended to include the following new license Article 419:

Not later than January 1, 2016, the licensee shall file with the Commission a plan for freshwater mussel restoration. The licensee shall be responsible for implementation of the plan, as follows: Commencing January 1, 2017, and continuing through and including January 1, 2026, the licensee shall contribute \$1,750 annually to the Shawano Resource Enhancement Fund established pursuant to Article 415 of this license, to be used by the licensee for the purpose of freshwater mussel

restoration. The licensee shall consult with the Menominee Indian Tribe of Wisconsin, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources on an annual basis starting on or before January 1, 2015 and through and including the year 2026 to discuss plans and schedules for freshwater mussel restoration efforts.

The licensee shall provide the draft plan to the U.S. Fish and Wildlife Service, Wisconsin Department of Natural Resources and the Menominee Indian Tribe for review, allowing 30 days for comments before filing the plan with the Commission. The plan shall include any letters of comment from these entities. The Commission reserves the right to require changes to the plan.

The licensee's obligations to implement the substantive terms of the freshwater mussel restoration plan will continue until all required mitigation set forth therein is completed. The Annual Accounting Report required by Article 415 of this license shall describe restoration efforts during the previous year and anticipated efforts for the coming year.

2. Pending expenditure for freshwater mussel restoration, the funds contributed by Wolf River pursuant to paragraph VI.J.1 shall be held in the Shawano Resource Enhancement Fund in accordance with the provisions set forth in paragraph VI.A.

Notice

Any notice, demand, request, waiver, or other communication under this Settlement Agreement shall be in writing (including facsimile, email, or similar writing) and shall be deemed to have been duly given (a) on the date of service if personally served, or (b) on the 10th business day after mailing if mailed to the party to whom notice is to be given by first class U.S. mail.

If to Wolf River, to: Wolf River Hydro Limited Partnership c/o Nelson Turcotte
36 Kimberly Drive Kapuskasing, Ontario P5N 1L5 Canada

If to the Menominee Indian Tribe: Chairperson, Menominee Indian Tribe of Wisconsin
P.O. Box 910 Keshena, Wisconsin 54135

If to the Department of the Interior: United States Department of the Interior
Office of the Solicitor 1849 C Street NW M.S. 6456 Washington, DC 20240

Additional Understandings.

A. This Settlement Agreement is made on the express understanding that it constitutes a negotiated settlement of issues specific to the Project. No Party shall be deemed, by virtue of execution of this Settlement Agreement, to have established precedent, or admitted or consented to any approach, methodology, or principle except as expressly provided herein. Commission

approval of this Settlement Agreement shall not be deemed precedential or controlling regarding any particular issue or contention in any other proceeding.

B. This Settlement Agreement shall become effective upon execution by all Parties and shall remain in effect for the term of an amended license issued by the Commission for the Project. This Settlement Agreement shall be binding on and inure to the benefit of the Parties and their successors and assigns, unless otherwise specified.

C. Each signatory to this Settlement Agreement represents that: (1) he or she is authorized to execute this Settlement Agreement and legally bind the Party he or she represents; and (2) the Party he or she represents will be fully bound by the terms hereof. This Settlement Agreement may be executed in any number of counterparts, and each executed counterpart shall have the same force and effect as if all the signatory parties had signed the same original instrument.

D. No Party may assign its rights or delegate its duties under this Settlement Agreement without prior written consent of the other Parties, which shall not be unreasonably withheld. This Settlement Agreement shall automatically be assigned to any license transferee upon issuance of a FERC order approving a total or partial transfer of the issued license as amended.

E. Except as explicitly provided herein, each Party agrees to bear its own costs and expenses.

F. In lieu of meetings, conference calls may be utilized.

In witness whereof, the Parties have executed this Settlement Agreement as of the dates set forth below.

WOLF RIVER HYDRO LIMITED PARTNERSHIP
(for signature page see original document)

Appendix D: 1995 Lake Sturgeon Management Plan

GOAL

A tribal, state and federal government cooperative plan to:

Establish/restore and maintain quality Lake Sturgeon populations and habitat on the Menominee Reservation that meets tribal needs and is supported by the public.

This plan deals with the issue of restoring and/or establishing one or more harvestable Lake Sturgeon populations in waters of the Menominee Reservation. While sections of this plan call for management activities which would impact fisheries on the section of the Wolf River between Keshena Falls and Balsam Row dam, the plan is limited to Lake Sturgeon only. The Menominee Reservation Sturgeon Management Planning Committee recognizes that the Balsam Row dam is currently involved in relicensing proceedings before the Federal Energy Regulatory Commission (FERC). The Menominee Tribe is participating in those proceedings and raising objections related to blockage of sturgeon passage. The FERC process could result in melioration or remediation of the effect of the dam on sturgeon access to the Wolf River above the dam. Following this planning effort, the Wisconsin DNR will be working jointly with the US Fish and Wildlife Service, the Menominee Tribe and the public to develop a comprehensive plan for management and enhancement of all fisheries of the Wolf River system. The Wolf River System plan will deal with a wide array of issues including management of within river fisheries populations, migratory fishes and the impact of the Shawano and Balsam Row dams on them, habitat preservation and management, user concerns, and other issues.

BACKGROUND

Lake Sturgeon is an important species in the Lake Winnebago-Wolf-Upper Fox River System, from biological, economic, social and cultural perspectives. Records of significant cultural and spiritual use of sturgeon by Menominee peoples date back to the late 1600's (Beck, 1993). Around the Winnebago region, sturgeon is an important part of local European settlement culture, primarily due to interests in the sport of spearing, and the uniqueness of the species.

Each spring sturgeon migrate from Lake Winnebago up the Wolf River to spawn at numerous rocky sites from New London upstream to the dam at Shawano (Figure I). Before the Shawano dam was constructed in the late 1880's some of the sturgeon were able to migrate during their spawning run up river as far as Keshena Falls on the Menominee Indian Reservation. The construction of the Balsam Row dam in the late 1920's created an additional barrier to the movement of fish. Currently there are no Lake Sturgeon known to be present in Reservation waters.

The Menominee Indian Tribe of Wisconsin has a long-standing tradition of utilizing sturgeon for cultural and spiritual purposes (Beck, 1993). The Tribe has a vested interest in re-establishing Lake Sturgeon in Reservation waters. In 1993, the Menominee Tribe held discussions with the Wisconsin Department of Natural Resources (WDNR), the U.S. Fish and Wildlife Service (USFWS), and the Bureau of Indian Affairs (BIA), to explore the possibility of returning Lake Sturgeon to the Menominee people. The discussion eventually led to the establishment of the multi-agency Menominee Reservation Sturgeon Management Planning Committee, which has been charged to develop a sturgeon management plan for the Menominee Reservation.

LAKE STURGEON LIFE HISTORY

Lake Sturgeon are a slow growing, long lived fish which typically inhabit large river systems in the upper midwest. In the Winnebago System sturgeon have been found to grow in excess of 160 lbs and 80 years old. Males do not mature until they reach age 13-15 (40"-43", 12-20 lbs) and females age 22-24 (55"-59", 40-60 lbs). Upon reaching maturity, males spawn typically once every two years, while females spawn once every four to five years. Spawning occurs at one or more of over 50 spawning sites on the Wolf and upper Fox Rivers, which flow into Lake Winnebago. In the fall and winter prior to spawning, a significant portion of the mature fish in spawning readiness begin to migrate out of Lake Winnebago and stage in the Upriver Lakes (Butte des Morts, Winneconne and Poygan) and in pools of the Wolf and upper Fox Rivers.

When spring water temperatures reach 50 to 56°F, the fish move onto the spawning grounds, rocky, current swept shorelines or rapids, to lay and fertilize their eggs. The fertilized eggs are adhesive and attach to the rocky substrate while incubating, finally hatching, after 8 to 14 days. The newly hatched fry find cover in the crevices of the rocky river-bed and remain in the area downstream from the spawning sites for 50 to 60 days. By the end of their first summer spent in the river, the fingerlings will be 5 to 8 inches in length.

Young sturgeon may spend up to two or more complete summers in the rivers before moving down into Lake Winnebago. In Lake Winnebago, the fish take advantage of the extensive habitat, and the usually abundant food sources of lake fly larvae, and as of late, gizzard shad. Lake Sturgeon are not fussy eaters and seem to be able to adapt quite well to whatever food item is readily available. Sturgeon have been observed with a wide range of prey in their guts, including plankton, insects, crayfish, fish, snails and clams.

Both males and females grow to 45 inches in total length in 12 to 14 years. Males and females generally grow at similar rates although females over 45" may grow a little faster. Females also typically live longer and therefore attain much larger sizes, making up most of the population of fish over 60 inches.

(References: Priegel and Wirth 1975, Folz and Meyer 1985, Kempinger 1987, Bruch 1993)

OBJECTIVES AND MANAGEMENT STRATEGIES

1.0 STURGEON POPULATIONS

Establishing and maintaining one or more harvestable Lake Sturgeon populations on reservation waters is the primary focus of this plan. Primary concerns in pursuing this are:

- developing a disease screening process for all hatchery reared fish used for restoration purposes,
- developing one or more populations that provide a harvestable stock,
- maintaining the genetic integrity, health, and size and age structure of the Wolf River/Winnebago Lakes sturgeon population,
- ensuring that long term propagation needs are met, and
- that scientifically sound assessments are conducted to track success of restoration efforts and measure

harvestable stock.

Developing an initial harvestable adult stock through a restoration effort will take a minimum of twenty-five years due to the late age maturation of the fish. Population levels listed in Objectives 1.4, 1.5, 1.6 and 1.7 of this plan are targets based on sturgeon population densities that currently exist in the Menominee River and Lake Winnebago.

The Sturgeon Enhancement Committee examined all waters on the Menominee Reservation that had potential for sturgeon management. Waters were examined for availability of habitat and water quality necessary for successful natural reproduction and maintenance of a viable Lake Sturgeon population. Two areas identified as having potential for natural maintenance of a sturgeon stock; in priority order, were 1) the Wolf River from Balsam Row dam to Keshena Falls, 2) the Wolf River above Keshena Falls to Big Eddy Falls (Figure 2). Two areas were also identified as having good potential for put-grow-and harvest sturgeon fisheries: 3) the Neopit Mill Pond-Bass Lake Complex, and the Legend Lake System (Figure 2). Ultimately, the success of the long-term restoration project will depend upon the availability of sturgeon (adults, juveniles, fingerlings, fry, sac-fry, and/or eggs) for stocking over an extended span of time, i.e. 25-50 years. Major implementation considerations of this plan are: 1) the potential impact of this plan on the Wolf River/Winnebago System stock of sturgeon, and 2) the importance of the Winnebago/Wolf strain sturgeon as an egg and stock source.

OBJECTIVES

1.1 Establish and maintain Lake Sturgeon population(s) with adult fish on Menominee Reservation waters by 2020.

1.2 Develop and maintain propagation facilities and resources to meet restoration/management needs by 1995.

1.3 Develop and implement an annual assessment of native and re-established stocks by 1995.

Strategies for Objectives 1.1, 1.2 and 1.3

- a) Restore/establish a viable Lake Sturgeon population in one or more of the Menominee Reservation option waters listed below.
- b) Develop federal propagation facilities to raise 10,000 fingerlings per year.
- c) Determine feasibility of tribal sturgeon propagation facility.
- d) Develop and implement a disease screening process prior to stocking any sturgeon fingerlings into the Wolf River System.
- e) Conduct an annual assessment of rehabilitated waters which monitors survival and growth of stocked fish, and movement and habitat usage of adults and juveniles.
- f) Enforce necessary regulations to protect sturgeon stocks.

Option Waters for Sturgeon Restoration/Establishment listed in priority order for self-sustaining and put-grow and harvest stocks

Self-Sustaining Stocks

To re-establish self-sustaining stocks of Lake Sturgeon in the mainstem of the Wolf River below and above Keshena Falls, this plan calls for transfer and/or stocking of fish from a population that resides year-round in the Wolf River below Shawano (primarily from the Shawano dam downstream to State Highway 156). It is believed this stock of fish does not migrate to or from Lake Winnebago. It also exhibits the riverine characteristics necessary to increase the probability that fish from this population transferred, or stocked below or above Keshena Falls will stay in those waters. For this reason, adult, sub-adult or fingerling sturgeon from the Lake Winnebago stock cannot be used in these waters as it is highly likely that they would move back downstream to the lake. The abundance of the riverine stock below Shawano will be determined through summer fisheries surveys and safe removal levels for adults and sub-adults will be established to ensure the stock is not negatively impacted.

Wolf River from Balsam Row to, Keshena Falls:

1.4 Re-establish a self-sustaining riverine population of 500 fish which eventually will include 60 adults.

Five miles of mainstem river with good natural reproduction potential, nursery and overwintering habitat.

Wolf River above Keshena Falls:

1.5 Establish a self-sustaining riverine population of 300 fish which eventually will include 36 adults.

Approximately 5 miles of river including West Branch up to Big Eddy Falls with good natural reproduction potential and nursery areas.

Strategies for Objectives 1.4 and 1.5

- a) Transfer adults and subadults from the Wolf River riverine stock below Shawano to target areas on mainstem Wolf River on the Reservation.
- b) Stock 1200 fingerlings from Wolf River riverine stock into target areas on mainstem Wolf River on the Reservation (fingerlings would be produced from eggs and sperm taken from sturgeon positively identified as adults from the Wolf River riverine stock).
- c) Radio tag-- adults and sub-adults, and, if feasible, fingerlings to track movement, distribution, and habitat utilization patterns.
- d) Make observations each spring at potential spawning sites for use by transferred adults.

- e) Identify location, quality and quantity of habitats required by various sturgeon life stages.
- f) Conduct fisheries surveys on target restoration waters to assess survival, growth and behavior of transferred and stocked fish.

Put-Grow-and-Harvest Stocks

Legend Lake:

1.6 Establish a lake population. of 1,875 sturgeon, which eventually will include 210 adults.

1500 acres of connected impounded waters in the Oconto River watershed with potential for put-grow-and-take, but low/no potential for natural reproduction

Neopit Mill Pond/Upper Bass Lake:

1.7 Establish lake population of 400 sturgeon which eventually will include 35 adults.

320 acres contained within two water bodies, Upper Bass Lake and Neopit Mill Pond with low/no potential for natural reproduction, but fair to good potential for put-grow-and-take.

Strategies for Objectives 1.6 and 1.7

- a) Stock Winnebago strain fingerlings (6000 in Legend Lake Complex, 820 in Neopit Mill Pond and 480 in Bass Lake) annually for five years, then assess survival and growth prior to subsequent stockings.
- b) Mark all fingerlings stocked for identification.
- c) Radio tag, selected subsample of fingerlings, if feasible, to track movement, distribution and habitat selection.
- d) Close non-tribal sturgeon fishing on Reservation waters through Wisconsin Department of Natural Resources administrative code revision.
- e) Monitor water quality seasonally in all lakes receiving sturgeon.

2.0 HABITAT

Adequate habitat for the various life stages of sturgeon is critical to the long-term maintenance of a natural and/or a stocked population. Waters that ultimately are targeted for establishment of a sturgeon population need protection, and where possible enhancement, of critical sturgeon habitats to ensure long term maintenance of a sturgeon population.

OBJECTIVES

2.1 Identify critical sturgeon habitats in selected rehabilitation waters by 1995.

2.2 Ensure protection of critical habitats through various jurisdictions' water quality, shoreline, and watershed protection program and permit processes.

2.3 Identify and develop habitat restoration actions by 1996.

Strategies for Objectives 2.1, 2.2 and 2.3

- a) Survey rehabilitation waters and identify important habitats and potential restoration sites/activities.
- b) Identify water and land protection programs and program - jurisdictional responsibilities.

3.0 TRIBAL ISSUES

The Menominee Tribe has a long history of sturgeon utilization for various cultural purposes (Beck, 1993). The Tribe celebrated the return of sturgeon to its ancestral spawning grounds at Keshena Falls along the Wolf River each spring by holding a tribal ceremony to mark a new beginning and a new life, which continues to this day. Tribal people endured long hard winters and relied heavily on sturgeon for meat and protein which they were lacking. Sturgeon were also selected to supply food for a tribal feast at the ceremony.

OBJECTIVES

3.1 Identify and weave Menominee cultural and traditional customs, values and issues into present and future tribal sturgeon management and use activities by 1995.

Strategies for Objective 3.1

- a) Complete David Beck report detailing the history of Menominee cultural and traditional values linked to Lake Sturgeon.
- b) Build Menominee cultural and traditional values into tribal sturgeon ceremonies and other activities.

4.0 ENFORCEMENT

Protection of developing sturgeon stocks from illegal harvest or abuse is also critical to the establishment of long-term harvestable population. The Menominee Conservation Commission will develop, and the Tribal Legislature will implement stringent rules and regulations governing sturgeon fishing by tribal members in the protected waters and protecting the sturgeon from illegal acts committed by tribal members. The rules will be similar to those of the Department of Natural Resources but will keep traditional cultural values intact. The Tribe and the WDNR will cooperate in promulgating rules closing all waters on the Reservation which will receive sturgeon under this plan to all fishing by nonmembers for the purpose of taking sturgeon. The Tribe and WDNR will explore cooperative arrangements for the adoption and enforcement of the regulations. This plan is not intended to alter existing jurisdiction of any party, and by approving the plan no party is conceding or agreeing to any jurisdiction in any other party which otherwise would not exist. The acceptance of this agreement shall not in any respect constitute a determination as to the merits of any allegation or contention, whether legal or factual, made by either party in any preceding now or in the future. The tribal, federal and

state governments agree that the transfer of adult fish to restoration waters will not take place until the appropriate agencies have enacted the regulations necessary to provide adequate protection of the sturgeon.

OBJECTIVES

4.1 Identify and institute appropriate Tribal and State regulations to provide adequate protection to rehabilitating sturgeon stocks by 1995.

Strategies for Objective 4.1

- a) Tribal and State law enforcement specialists identify enforcement actions and strategies necessary to protect rehabilitating sturgeon stocks and recommend regulatory changes/additions through respective rule making processes.*
- b) Promulgate regulations to protect sturgeon stock prior to stocking any adult fish.*

5.0 PUBLIC INFORMATION AND EDUCATION

Tribal and non-tribal publics have a strong interest in Lake Sturgeon use and management on the Wolf-Winnebago System. The Sturgeon Enhancement Committee recognizes this interest and will work jointly to keep various publics regularly informed on the status and impact of management recommendations and activities.

OBJECTIVES

5.1 Maintain an open flow of information with Tribal and non-tribal publics interested in Wolf-Winnebago sturgeon management and use.

Strategies for Objective 5.1

- a) Hold public informational meetings to discuss draft sturgeon management plan and enhancement activities.
- b) Prepare news releases as necessary to inform the public of significant decisions, events, etc concerning the Sturgeon Enhancement Committee, the sturgeon plan, Tribal sturgeon activities, etc.
- c) Publish annual report on progress of Sturgeon Enhancement Plan and restoration activities.
- d) Publish Menominee Reservation Sturgeon Management Plan and provide to interested publics.
- e) Develop a brochure on the Menominee Sturgeon Management Plan including Tribal traditions, sturgeon management, and life history.
- f) Develop and maintain tribal and non-tribal public awareness of Lake Sturgeon life history, and restoration and management efforts through a continuing education program.

IMPLEMENTATION

The Menominee Reservation Sturgeon Management Plan will be implemented by the administrative, management and regulatory authority represented on the Menominee Sturgeon Reservation Sturgeon Management Planning Committee with full realization of the plan's goals taking perhaps 25 to 50 years. Funding will likely come from a variety of sources including the Menominee Tribe, the US Fish and Wildlife Service, the Bureau of Indian Affairs, and the Wisconsin Department of Natural Resources. The Sturgeon Enhancement Committee would continue through plan implementation to ensure tribal and non-tribal input on common sturgeon management and use issues.

The Menominee Reservation Sturgeon Management Planning Committee is an interagency task force comprised of the following individuals:

Rod Boivin, Co-Chairman, Menominee Conservation Commission

James Moore, Co-Chairman WDNR-Green Bay, WI

Ron Bruch WDNR-Oshkosh, WI

Hannibal Bolton USFWS-Fort Snelling, MN

Doug Cox Menominee Tribe Env. Services

Shirley Daly Menominee Tribe Vice Chair

Verna de Leon Menominee Tribe Public Relations

Jim Fossum USFWS-Green Bay, WI

Leon Fowler Menominee Tribe Conservation Dept.

George Howlett Menominee Tribe Hydrologist

Charles Leonard Menominee Tribal Public Relations Consultant

Bob Jackson, BIA-Minneapolis, MN

Larry Kriese, WDNR Green Bay, WI

Don Reiter, Menominee Tribe Conservation Dept.

Pam Thiel, USFWS Winona, MN

Tom Thuemler, WDNR-Marinette, WI

References

BECK, DAVID. -1993 Historical use of Lake Sturgeon by Menominee peoples of Wisconsin. Menominee Tribe. Unpublished draft.

BRUCH, RONALD M. 1993. Winnebago System Lake Sturgeon Population and Harvest Assessment Data. Wis. Dept. of Nat. Resour., Oshkosh, WI. Unpublished.

FOLZ, DANIEL J. AND LEES. MEYERS. 1985. Management of the Lake Sturgeon, *Acipenser fulvescens*, population in the Lake Winnebago system, Wisconsin. pp 135-146. In:

F.P. Binkowski & S.I. Doroshov (ed.), North American Sturgeons. Dr. W. Junk Publishers, Dordrecht.

KEMPINGER, JAMES J. 1988. Spawning and Early Life History of Lake Sturgeon in the Lake Winnebago System. American Fisheries Society Symposium 5:110-122, 1988.

PRIEGEL, G.R. AND T.L. WIRTH. 1975. Lake Sturgeon Harvest, Growth, and Recruitment in Lake Winnebago, Wisconsin. Wis. Dept. of Nat. Resour. Tech. Bull. No. 83. 25 PP.

The foregoing Lake Sturgeon Management Plan is hereby acknowledged as follows:

ACKNOWLEDGED:

See Original for Signatures

Appendix E: Memorandum of Understanding Between WDNR and MITW

MEMORANDUM OF UNDERSTANDING (MOU)

Between the Wisconsin Department of Natural Resources
And the Menominee Indian Tribe of Wisconsin Regarding Transferring Lake Sturgeon

This Memorandum of Understanding (MOU) is entered into between the Wisconsin Department of Natural Resources (WDNR) and the Menominee Indian Tribe of Wisconsin (MITW);

WHEREAS, the WDNR is authorized to cooperatively enter into this MOU pursuant to Wis. Stat. ss. 23.09 (2)(t) and (h); and

WHEREAS, MITW is authorized to enter this MOU pursuant to the Constitution and Bylaws of the Menominee Indian Tribe; and

WHEREAS the purpose of this MOU is to allow for the transfer of Lake Sturgeon from the lower Wolf River (below the Shawano Paper Mill Dam) to the upper Wolf River (above the Shawano Paper Mill Dam and the Balsam Road Dam) to meet MITW sturgeon restoration objectives; and

WHEREAS Viral Hemorrhagic Septicemia Virus (VHS) challenge tests completed recently by Dr. Mohamed Faisal, DVM & Professor Aquatic Animal Medicine, at Michigan State University have shown that Lake Sturgeon are not susceptible to VHS virus; and

WHEREAS current VHS policies and rules allow for the upstream transfer of non-susceptible species within a water system providing the fish are visually inspected by and receive a fish health certificate from a qualified fish health inspector; and

WHEREAS MITW shall assist WDNR with the development and implementation of a public involvement process to discuss Tribal sturgeon goals and management strategies designed to address Tribal sturgeon restoration objectives.

NOW, THEREFORE, MITW and WDNR (the Parties) do hereby agree to the following terms and conditions:

I. DEFINITIONS:

For the purposes of this MOU:

- A. "Menominee Tribal Sturgeon Restoration Team" means a group composed of technical and administrative representatives from MITW, WDNR, the US Fish and Wildlife Service, and the US Bureau of Indian Affairs formed for the purpose of evaluating the MITW objectives

of restoring migrant spawning Lake Sturgeon and resident Lake Sturgeon in the Wolf River in the Menominee Reservation.

II WDNR RESPONSIBILITIES

To the best of its ability, within its authority, and dependent on appropriation of funds for such purposes, WDNR agrees to:

- A. Lead Lake Sturgeon capture and transfer operations with a goal of capturing and transferring 115 Lake Sturgeon a year,
- B. Plan and review jointly and annually these capture and transfer operations with MITW.
- C. Will discuss the MITW objectives of restoring migrant spawning Lake Sturgeon and resident Lake Sturgeon in the Wolf River in the Menominee Reservation.
- D. Work with the Menominee Sturgeon Team, appropriate WDNR staff, and the Winnebago Sturgeon Citizens Advisory Committee to develop and implement a public involvement process to discuss the Menominee Sturgeon cultural goals and potential strategies to address those goals.
- E. Capture Lake Sturgeon in three time periods from the Wolf River between Shawano and Leeman as follows:
 - 1) August-September- 30 Lake Sturgeon 2: 40 inches total length in an effort to transfer and establish Wolf River resident adult and sub-adult sturgeon in Reservation waters of the Wolf River;
 - 2) October-November- 35 migrant Lake Sturgeon, all gravid adults, 25 males and 10 females;
 - 3) April- 35 migrant Lake Sturgeon, all gravid adults, 25 males and 10 females for release, and 15 males for annual MITW sturgeon ceremony.
- F. Transfer Lake Sturgeon to release sites and according to a study design agreed upon by the Menominee Tribe Sturgeon Restoration Team.
- G. Assist MITW with surgical implantation of 10-year sonic telemetry tags in, and sexing and staging as many of the transferred sturgeon as possible (except ceremonial sturgeon which are not released), and with initial deployment and operation of sonic receivers and collection and processing of sonic telemetry data.
- H. Deploy and operate additional receivers needed to cover the Wolf River between the Menominee Reservation boundary and the Shawano Paper Mill dam, including the Red River tributary upstream from Shawano when needed.
- I. Provide up to 20 telemetry tags each year for transferred adult migrant sturgeon.
- J. Assist MITW in setting up a "sturgeon guard program" that protects spawning sturgeon relocated to waters located within the boundaries of the Menominee Reservation.
- K. Continue to function as a member of the Menominee Tribe Sturgeon Restoration Team.
- L. Share all telemetry data collected on transferred sturgeon with MITW.

III - MITW RESPONSIBILITIES

To the best of its ability, within its authority, and dependent on appropriation of funds for such purposes, MITW agrees to:

- A. Provide a qualified fish health inspector free of charge on site on each capture and transfer day to do the inspection and provide the required fish health certificate prior to transfer and release.
- B. Provide the remaining sonic tags free of charge needed each year to meet study design objectives and operate receivers deployed in waters located within the boundaries of the Menominee Reservation.
- C. Share all telemetry data collected free of charge on transferred sturgeon with WDNR.
- D. Set up a "sturgeon guard program," in coordination and consultation with WDNR, that protects spawning sturgeon relocated to waters located within the boundaries of the Menominee Reservation.

GENERAL TERMS AND CONDITIONS

A. Preservation of Jurisdiction

Nothing in this MOU shall be construed as a grant or waiver of jurisdiction by either of the Parties. This MOU is not intended to alter the existing authority, rights or claims of any Party. No Party concedes or agrees to any jurisdiction or authority of any other Party that would not otherwise exist. Acceptance or signing of this MOU shall not in any respect constitute a determination as to the merits of any allegation or contention whether legal or factual by either Party in any proceeding now or in the future, nor does the MOU constitute any determination as to the scope of WDNR's permitting authority on the reservation or the authority of MITW over non-tribal members. WDNR's agreement to this MOU does not constitute a waiver of its sovereign immunity. The MITW's agreement to this MOU and its participation in the permitting process of the WDNR does not constitute a waiver of its sovereign immunity.

Liability

- 1) With respect to liability to third Parties arising out of the performance of this MOU, on behalf of itself, its officers, directors, members, employees, personnel, agents, and representatives, each Party agrees that it shall be responsible for its own acts and omissions and the results thereof and that it shall not be responsible for the acts or omissions of the other Party, not the results thereof to extend authorized by Wisconsin Law. Each Party therefore agrees that it shall assume the risk and liability to itself, its agents, employees, personnel, and volunteers for any injury to or death of persons or loss or destruction of property resulting in any manner from the Party's own operations and/or the operations of its agents, employees, personnel, and/or volunteers under this MOU.
- 2) The WDNR shall not be liable beyond that liability established in Wis. Stats. Ss 893.82 or 895.46, or as otherwise established by the State Claims Board and approved in accordance with these statutes.

Agency and Workers Compensation

- 1) Although MITW may be directed, at times, by the WDNR to assist in certain duties or tasks as part of the implementation of this MOU, it is understood that MITW, its employees, agents, and members shall not be deemed employees or agents of the WDNR for any purpose, including workers compensation. Workers compensation coverage for the employees, agents, and members of MITW shall be provided by MITW.
- 2) MITW personnel shall remain on MITW's payroll and protected under MITW's Workers compensation plan for the entire period that they have been authorized to assist the WDNR in any activities surrounding the implementation of this MOU.

Life of Agreement

This MOU will become effective upon being completely executed by all Parties and will remain in full force and effect until August 14, 2021. If not terminated or amended, this MOU will renew automatically for additional ten (10) year periods starting from the date of expiration on August 14, 2031; August 14, 2041; August 14, 2026, *ad infinitum*.

Termination

Either Party may terminate this MOU upon 30 days written notice to the other Party.

Agreement

This MOU and its referenced parts, attachments and addendums shall constitute the entire agreement and previous agreements, whether written or oral, are hereby superseded. This MOU does not affect the Sturgeon Management Plan which is already in place.

Amendment

Any revisions must be made by amendment to this MOU or other written documentation and signed by both Parties and will take effect upon signature of the modified document by all Parties.

Authorization

Each person signing this MOU personally warrants and represents that he or she is authorized by his or her principle to bind the Party for whom he or she is signing.

Appendix F. Wolf River Comprehensive Management Plan Proposal

Water Resources Management Plan proposal for the Wolf River, from Shawano Paper Mill Dam (P-8015) to Keshena Falls and tributaries, Shawano and Menominee Counties, Wisconsin, for the Wolf River/Balsam Row dam (P-710)

Date: October 28, 2015

PURPOSE STATEMENT

Fish passage has been proposed at the Balsam Row hydroelectric dam. The Department is participating in the technical evaluation of the proposed project. To effectively participate in the technical evaluation of the proposed fish passage project, a strong understanding of the current environment above and below the Balsam Row dam is needed. For the purposes of this discussion, the project area is defined as the waters of the Wolf River from the Shawano Paper Mill hydroelectric dam to Keshena Falls, and tributaries.

COMPREHENSIVE WATER RESOURCES ASSESSMENT

Proposed assessments will provide scientific data and information on the aquatic environment from the Shawano Paper Mill hydroelectric dam upstream to Keshena Falls. The assessment will focus on a comparison of the ecological attributes above and below the Balsam Row hydroelectric dam. The results of the assessment will be used to develop a resource management plan. The management plan can be used as a reference for the technical evaluation associated with the proposed fish passage project at the Balsam Row dam.

KEY QUESTIONS THE DEPARTMENT WILL ANSWER

1. What is the current status of the aquatic environment, including game fish, non-game fish, macro-invertebrates, mussels, invasive species, habitat, and water quality above and below the Balsam Row hydroelectric dam?
2. What is the distribution of mussels and their reproductive host species?
3. What is the distribution of aquatic invasive species, and their risk of moving past the Balsam Row hydroelectric dam?
4. What threatened and endangered species are present?
5. What are the goals and objectives for managing the aquatic resources in this section of river?

OVERVIEW OF ASSESSMENTS TO BE COMPLETED

1. Complete comprehensive fish, macro- invertebrate, and mussel population surveys
2. Complete comprehensive aquatic invasive species surveys
3. Complete qualitative and quantitative mussel surveys
4. Complete habitat assessments for fish, macro-invertebrate, mussels

5. Evaluate the potential of movement of aquatic invasive species from below the dam to above the dam
6. Complete standard water chemistry assessments for the river

TIMELINE TO COMPLETE THE WATER RESOURCES MANAGEMENT PLAN

March 2016 – October 2016: Field Work

November 2016 – April 2017: Summarize field data / Draft Management plan

May 2017 – July 2017: Engage Public & Stakeholders and Identify Management Goals and Objectives / Finalize Management plan. Plan may need Natural Resources Board approval once complete.

Framework for a Comprehensive Water Resources Assessment, for the Development of a Water Resources Management Plan for the Wolf River from the Shawano Paper Mill Hydroelectric Dam to Keshena Falls and Associated Tributaries, Shawano and Menominee Counties, Wisconsin

October 28, 2015

Table 1: Sampling and data collection

Table 2: Existing and historical department information and resource data

Section 1: Background, Location, Purpose:

1. Background
2. Physical location of the area of the management plan. Description of the aquatic environment, and ecological context.
3. Purpose of the water resources management plan

Section 2: Water levels and Flows:

1. Identify FERC license requirements for Wolf River Hydro that impact water levels and flows

Section 3: Fisheries Management Assessment (*Game fish, Pan fish, Non-game fish*)

1. Introduction on need for fisheries assessment with an emphasis on comparing fish populations above and below the Balsam Row Dam, to evaluate fish passage necessity and efficacy.
2. Identify fish community and evaluate important population metrics and habitat availability.
3. Review existing gamefish/pan fish population data
4. Additional data needed to evaluate above comparisons
5. Fish management with Tribal Cultural Needs

1995 Sturgeon Management Plan
2011 WDNR and MITW MOU

6. Evaluate habitat availability above and below Balsam Row dam.

Section 4: Aquatic Invasive Species

1. Review the Wisconsin Department of Natural Resources Fish Passage Guidance and complete the necessary assessment tools.
2. Complete additional surveys as necessary to provide information to answer the questions in the guidance
3. Apply the Fish Passage Guidance to determine the risk of AIS and potential movement of AIS

Section 5: Mussels

1. Introduction on need for mussel assessment, general with an emphasis on comparing mussel populations above and below the Balsam Row Dam.
2. Review existing mussel data

3. Identify additional data needed to answer above comparisons
 - a. Conduct a qualitative and quantitative mussel survey from the Shawano Paper Mill Hydroelectric Dam up to Keshena Falls, including NHI listed species.
 - b. Evaluate presence of host species from surveys and determine if any species are limited by barriers.

Section 6: public involvement and plan development

1. Analyze and summarize the data
2. Present the data to the public and stakeholders
3. Develop the management plan

NOTE: Considerations, Restrictions, Limitations:

- a. The Tribe and other organization, such as the USFWS, may have resource data that would be valuable to the development of this resource management plan. This effort would likely save staff time and money.
- b. The survey work will likely require access to the river within the reservation boundary.
- c. May need to revise the sampling timeline and provide adaptability to the plan, as field conditions dictate. This may be due to staffing limitations, weather considerations, new issues that may be identified, etc.
- d. Recommend that observations made during field collection that may affect the plan be fully documented, and further consideration be made as to the need for more formal surveys and data collection.
- e. Some of the data collection protocols are draft. At the time of data collection, the most current recommended survey methods should be applied.
- f. Budget and work planning should be established prior to committing staff to this proposed schedule. This project would rely on staff time and expertise from multiple divisions and bureaus. We recommend that each program develop a budget proposal to implement the tasks and develop the management plan.
- g. Fish advisory/consumption toxicity sampling and sediment analysis may occur after literature review.

Table 8 Sampling and Data Collection 2016

Protocol	Gear	Temp. Range/Time of year	Species	Data	Metrics
Spring Netting I (SNI)	Fyke Net: 4'x6', ¾" bar mesh	Ice out to 40-50 F Between late March-May	Measure Walleye, Northern Pike, and Muskellunge. Measure sub-sample of Black Crappie, Yellow Perch, and other panfish.	Mark/recapture – Walleye, Northern Pike and Muskellunge; length frequency; ageing structures	PE (Walleye); PSD/RSD (other gamefish); age & growth (Walleye)

Spring Electrofishing I (Walleye CPE)	Boom shocker, 3/8" mesh dip net bags	45 – 50 F Between late March and May	Measure all Walleye; (Walleye recapture on Treaty/High Profile Walleye lakes)	Length frequency; counts; distance and time shocked	CPE; PSD/RSD; age & growth
Spring Netting II (Muskellunge Netting)	4'x6', 3/4" bar mesh	50 - 55 F Between April and May	Measure/weigh all Muskellunge. Mark Muskellunge (optional).	Length frequency	PSD/RSD (combine with Spring Netting I data), PE (optional)
Spring Electrofishing II (Centrarchid CPE)	Boom shocker, 3/8" mesh dip net bags	55 - 65 F Between May and June	Measure all Largemouth Bass and Smallmouth Bass, count all panfish and measure 250 of each species; count Common Carp	Length frequency; counts; distance and time shocked; aging structures	CPE, PSD/RSD, age and growth
Summer Netting (Panfish Netting)	4'x6', 3/4" bar mesh	65 – 80 F Between May and June	Count all panfish and measure 250 of each species	Length frequency	PSD
Fall Electrofishing (Juvenile Assessments)	Boom shocker, 3/8" mesh dip net bags	55 - 65 F Between August and October	Count and measure all Walleye < 10" and musky < 20"	Length frequency; counts; distance and time shocked; aging structures	Juvenile CPE; age
Non-wadeable stream assessments - Extended daytime electrofishing	boat mounted, pulsed-DC electrofishing unit	between June 15 and September 30	All species	length frequency, catch per effort, count, individual lengths and weights	CPE, PSD/RSD
Non-wadeable Fish IBI	Mini-boom shocker 17mm stretch mesh	June 15 – September 30	Count individual fish of every species; measure and weigh all gamefish individually; Separate aggregate weight of all other species	Large River IBI	
Wadeable Fish IBI	Stream shocker/Tow Barge	June 15 – September 30	Count individual fish of every species; measure and weigh all gamefish individually	Warm water IBI	
Seining Surveys (for cyprinids)	Seine – mesh size TBD	June 15-Sept 30	All species	length frequency, count, individual lengths and weights	

Guidelines for sampling microinvertebrates in wadeable streams	D-frame Kick net	Fall	All species	M-IBI, H-IBI, F-IBI, %EPT, Species Richness, etc...	
Guidelines for sampling microinvertebrates in non-wadeable streams	Hester-Dendy Sampler	Deploy for 6 weeks between July and October	All species	M-IBI, H-IBI, F-IBI, %EPT, Species richness, etc...	
Guidelines for sampling habitat in wadeable streams	35xMSW for sampling station where wade-able fish IBI was conducted	June 15-September 30	Quantitative habitat metrics	Fish habitat rating and score, multiple other habitat metrics	
WisCalm 2016	Grab samples continuous data loggers	May-October	Various water quality parameters	TP, TSS, Nitrogen Series, Dissolved Oxygen, pH, Conductivity, Temperature	
Guidelines for sampling freshwater mussels in wadeable streams (WDNR 2005)	Sampling gear, quadrants, mask & snorkel/dive gear, boat	June 1 – Sept 30	All species	Length, sex, age, density, distance to shore, water depth, flow, substrate, live/dead/relic conditions,	
Surveys for mudpuppy (host of Salamander Mussel)	TBD, as part of other surveys.	Per sampling event	Only one species	Presence / absence	
Aquatic Invasive Species Monitoring in Streams	Boat/canoe, GPS, waders, double headed plant rake, D-net	Between June 15 and September 15	AIS aquatic plants (Eurasian watermilfoil, curly-leaf pondweed, etc.); AIS invertebrates (zebra mussels, faucet snails, mystery snails, rusty crayfish, etc.)	Presence/absence; semi-quantitative density estimates	
Aquatic Invasive Species Early Detection Monitoring in Lakes	Boat, GPS, double headed plant rake, plankton nets (50 & 250 µm),	Between June 15 and September 15	AIS aquatic plants (Eurasian watermilfoil, curly-leaf pondweed, etc.); AIS invertebrates (zebra mussels, faucet	Presence/absence; semi-quantitative density estimates	

	D-net, snorkeling gear		snails, mystery snails, rusty crayfish, etc.)		
Recommended Baseline Monitoring of Aquatic Plants in Wisconsin	Boat, GPS, double headed plant rake (pole and rope), PI map & points	Between June 15 and September 1	All aquatic plant species	Presence/absence; max depth of colonization, species richness & diversity, semi-quantitative density estimates, FQI	

Table 9 Existing and Historical Department Information and Resource Data

Waterbody	Survey Type	Year Completed
Wolf River	Distribution and Relative Abundance of Snuffbox in the Wolf River	2014
Shawano Lake	Spring Fyke Net Survey (SN2)	2015
Shawano Lake	Spring Fyke Netting (SN1)	2014
Shawano Lake	Spring Electrofishing - Walleye (SE1)	2014
Shawano Lake	Spring Electrofishing - Centrachids (SE2)	2014
Shawano Lake	Fall Electrofishing	1991-2014
Shawano Lake	Musky Recapture Survey (SN2)	2011
Shawano Lake	Spring Fyke Netting (SN1)	2010
Shawano Lake	Spring Electrofishing - Walleye (SE1)	2010
Shawano Lake	Spring Electrofishing - Centrachids (SE2)	2010
Shawano Lake	Spring Fyke Netting (SN1)	2006
Shawano Lake	Spring Electrofishing - Walleye (SE1)	2006
Shawano Lake	Spring Electrofishing - Centrachids (SE2)	2006
Shawano Lake	Summer Fyke Net Survey	2006
Shawano Lake	Summer Mini Fyke Net Survey	2005
Shawano Lake	Summer Fyke Net Survey	2002
Shawano Lake	Sensitive Area Survey	2003
Shawano Lake	Spring Fyke Net Survey	1986, 1990, 1996
Shawano Lake	Stocking Reports	historical
Shawano Lake	Aquatic Plant Point-Intercept Survey	2005
Shawano Lake	Baseline Aquatic Plant Monitoring (PI) Survey	2013, 2015
Wolf River (downstream of Balsam Row Dam to Pond)	Spring and Late Summer Electrofishing	2014
Wolf River Pond	Spring Fyke Netting (SN1)	2014
Wolf River Pond	Spring Electrofishing - Walleye (SE1)	2014

Wolf River Pond	Spring Electrofishing - Centrachids (SE2)	2014
Wolf River Pond	Summer Mini Fyke Net Survey	2005
Wolf River Pond	Fall Electrofishing	2005
Wolf River Pond	Spring and Fall Electrofishing	1991
Wolf River Pond	Spring Fyke Netting	1990
Wolf River Pond	Spring Electrofishing	1983
Wolf River Pond	Stocking Reports	historical
Wolf River Pond	Aquatic Invasive Species Early Detection Monitoring in Lakes	2012, 2013
Shawano Lake Outlet Channel	Spring Electrofishing	1977
Shawano Lake Outlet Channel	Aquatic Invasive Species Monitoring in Stream; Early Detection Pilot Project	2015
Shawano Lake Outlet Channel	Spring Fyke Netting (SN1)	2006, 2010
Shawano Lake Outlet Channel	Stocking Reports	historical
Balsam Row Pond	Spring Electrofishing - Centrachids (SE2)	2011
Balsam Row Pond	Spring Fyke Netting - Centrachids (SN3)	2011
Balsam Row Pond	Fall Electrofishing	, 1990, 1999
Balsam Row Pond	Spring Fyke Net Survey	1990
Balsam Row Pond	Summer Electrofishing	1977
Balsam Row Pond	Stocking Reports	historical
Red River (downstream Weed Dam)	Distribution and Abundance of River Redhorse and Greater Redhorse in the Red River near Gresham Municipal Utilities' Upper Red Lake (FERC No. 2484) and Weed Dam (FERC No. 2464) Hydroelectric Projects	2010
Red River (downstream Weed Dam)	Red River Freshwater Mussel and Fisheries Assessment for Relicensing the Gresham Municipal Utilities Upper Red Lake (FERC No. 2484) and Weed Dam (FERC No. 2464) Hydroelectric Projects	2011
Red River (downstream Weed Dam)	Miniboom Electrofishing Survey	1982, 1983, 1987, 1988
Red River (downstream Weed Dam)	Stocking Reports	historical
Red River	Freshwater Mussel and Fisheries Assessment for Relicensing the Gresham Municipal Utilities Upper Red Lake (FERC No. 2484) and Weed Dam (FERC No. 2464) Hydroelectric Projects.	2012

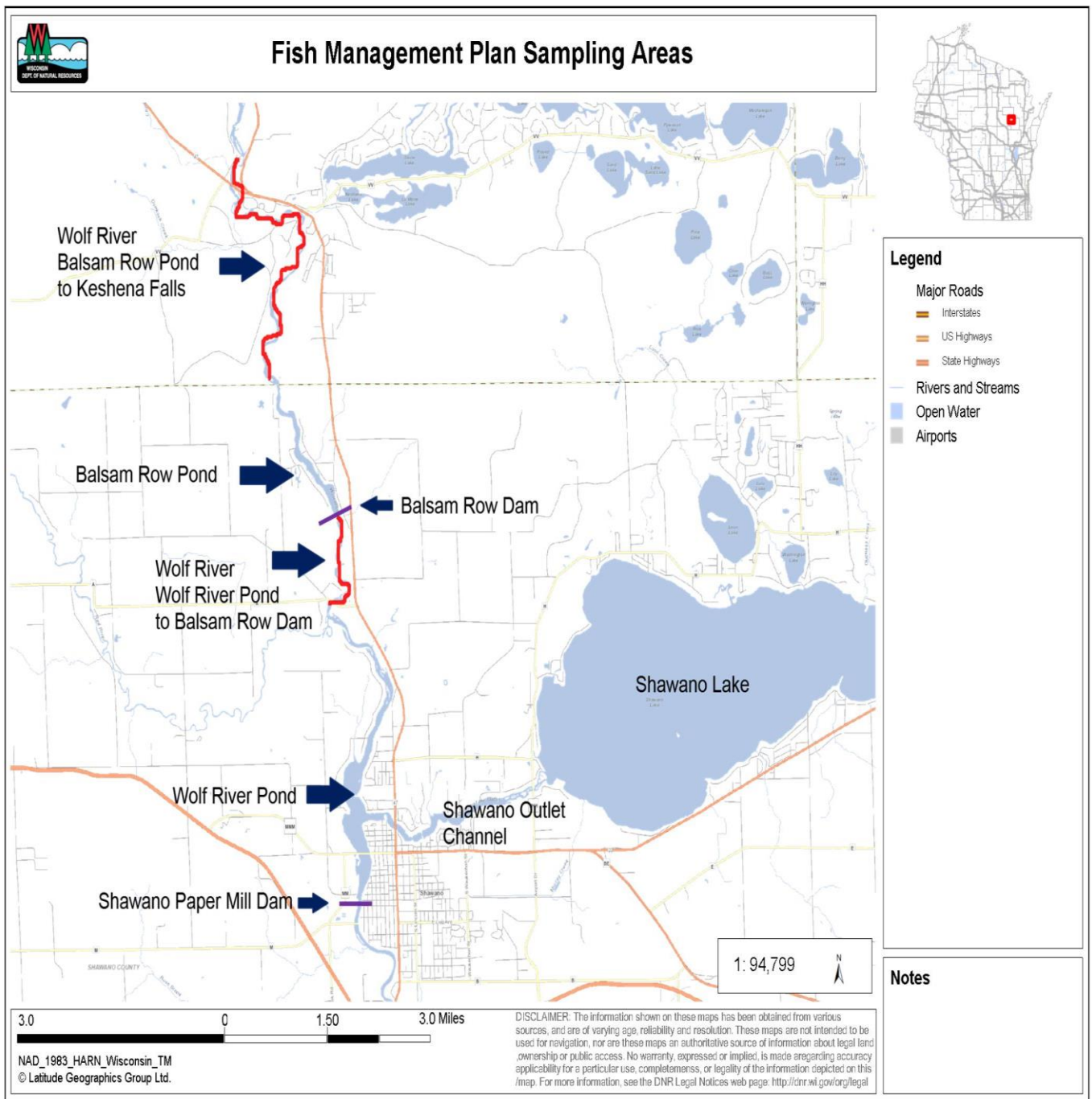


Figure 11 Fish Management Sampling Areas

Appendix G: Water Quality Survey

Introduction: Water chemistry within the Wolf River is an important driver to the biological communities that the river can support. The hydrologic modifications of the Wolf River by the Shawano Paper Mill Dam and Balsam Row Dam have altered the physical and chemical dynamic of the river ecosystem. The scope of this monitoring effort was to evaluate current water quality conditions of the Wolf River above the Balsam Row Dam and between the Balsam Row Dam and Shawano Paper Mill Dam to detect differences that may be caused by the dams and to evaluate water quality relative to State Water Quality Standards (WDNR 2016).

Study area: Two water chemistry samples were collected; 1) below the footbridge downstream of Hwy 47 at the end of a run and the start of a riffle; and 2) at the CTH A bridge within a run. (See Figure 12). Additionally, other water quality parameters were collected as part of additional field sampling.

Methods: Department Standard Operating Procedures (SOPs) were followed for water chemistry grab samples. Samples were collected monthly during the 2016 growing season at each station. During each site visit, data collection included air temperature, water temperature, conductivity, dissolved oxygen, dissolved oxygen percent saturation, pH, and water clarity. Surface water grab samples were analyzed by the Wisconsin State Lab of Hygiene for total phosphorus, orthophosphate, total suspended solids, total Kjeldahl nitrogen, nitrate-nitrite, and ammonia.

An Onset Hobo water temperature data logger was placed near both water chemistry monitoring locations at CTH A and the footbridge below STH 47 following Department SOPs. Temperature readings were collected every 15 minutes from May through October 2016. Temperature data were used to determine relative differences in thermal regimes for the Wolf River to ascertain maximum daily average summer-time temperatures.



Figure 12 Water Chemistry Sampling Locations

Results: The parameters collected were reviewed and evaluated against the Department's methodology for determining water quality impairment (WDNR 2016). Based on physical and chemical water quality parameters, the overall water quality within the Wolf River from Keshena Falls to the Shawano Paper Mill Dam is qualified as good to excellent.

The median total phosphorous concentration for both sites is below the 0.1 mg/l, indicating no exceedance of the total phosphorus criteria. The total suspended solids concentrations were below the proposed target of 12 mg/l as identified in the draft Upper Fox and Wolf River TMDL.

Table 10 Summary of monthly water quality data collected by grab sampling at sites within the Study Area (=Total N result)*

	May		June		July		Aug		Sept		Oct	
Site	Hwy 47	CTH A	Hwy 47	CTH A	Hwy 47	CTH A	Hwy 47	CTH A	Hwy 47	CTH A	Hwy 47	CTH A
Temp (°C)	11.3	11.9	21.95	21.1	24.27	25.4	20.8	21.6	17.4	18.4	6.9	6.9
Cond (us/cm)	226	226	233	239	292	289	261	269	274	274	247	252
DO (mg/l)	9.6	9.6	8.8	7.63	8.2	6.3	8.6	5.9	9.3	7.3	9.4	9.4
DO %	90.1	90.2	100.7	85.9	96.6	72.6	95.1	65.7	95.7	79.2	78.3	77.4
pH	8	8.1	8.1	7.86	7.9	7.96	8	8	8	7.9	7.6	7.9
TSS (mg/l)	4.4	3.6	8.67	9	2.2	4.4	5.71	6.4	6	7.6	4	3.2
NH3	nd	0.0166	0.019	0.0395	0.0239	0.0318	0.0151	0.0383	0.0197	0.0313	nd	nd
TKN	0.591*	0.633*	0.712	0.723	0.451	0.408	0.619	0.51	0.542	0.682	0.541	0.607
NO2	0.224	0.21	0.207	0.196	0.14	0.125	0.111	0.152	0.163	0.193	0.187	0.24
TP	0.0241	0.0257	0.0444	0.0492	0.0215	0.0265	0.036	0.0356	0.0345	0.0386	0.0308	0.0307
Ortho P (mg/l)	nd	nd	0.0064	0.0077	0.0026	0.0048	0.0034	0.0053	0.0058	0.0066	0.0053	0.0055
Trans (cm)	>122	>122	105	87	>122	>122	>122	>122	>122	105	>122	>122

Total Suspended Solids (TSS): TSS sampling includes both inorganic and organic solids, including soil particles, suspended detritus, and algae cells. In May and October, TSS concentrations were lower at sample site B. In June through September, TSS concentrations were 0.3 to 2.2 mg/l greater at sample site B. Higher TSS concentrations may have been caused by algal production or could be related to recreational boating activity can cause resuspension of bottom sediments. Regardless of the cause, these differences were small and likely do not strongly influence the biological communities within the Study Area (Figure 13).

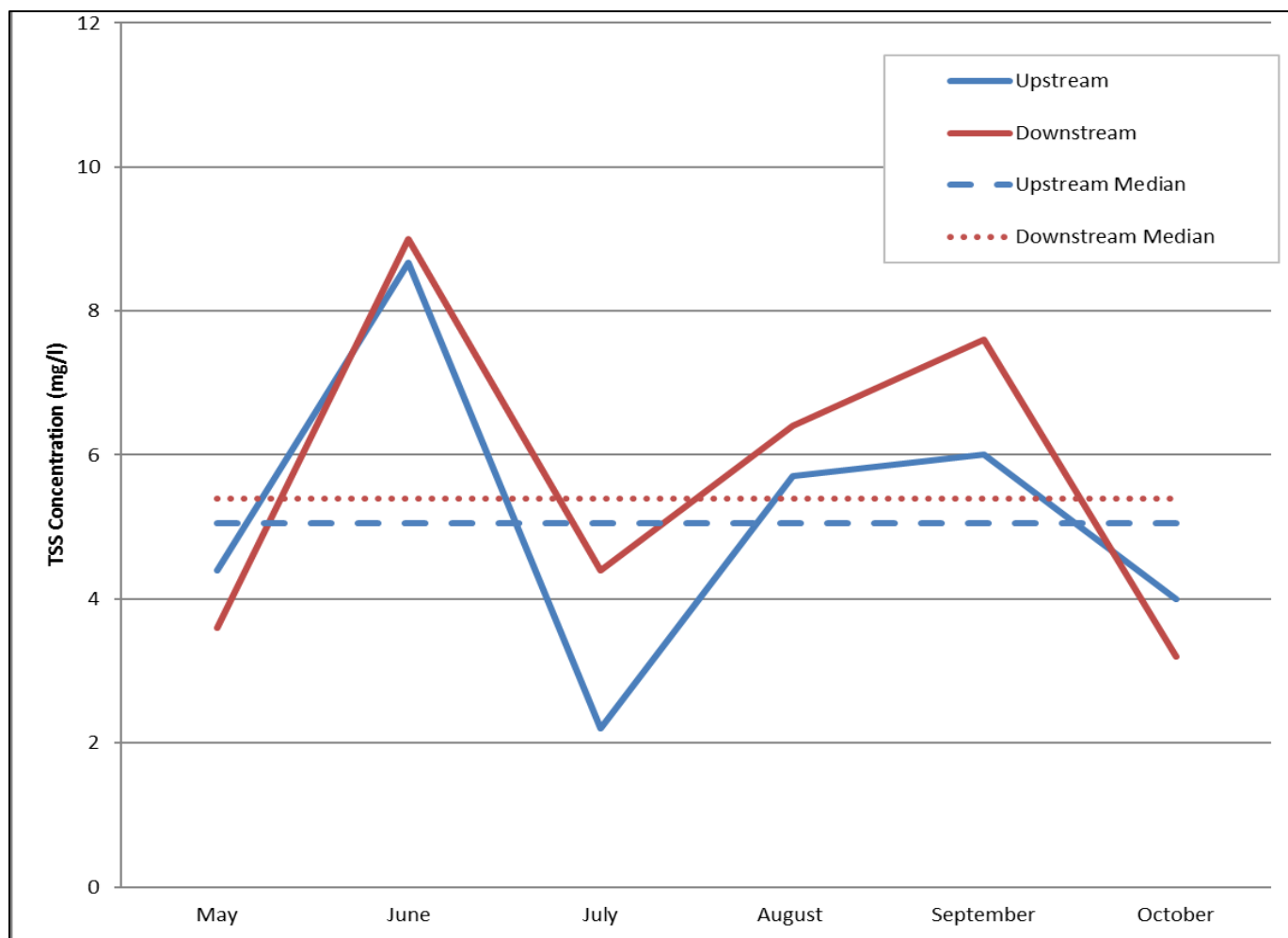


Figure 13 Total Suspended Solids Concentrations Upstream and Downstream of Balsam Row Dam (2016)

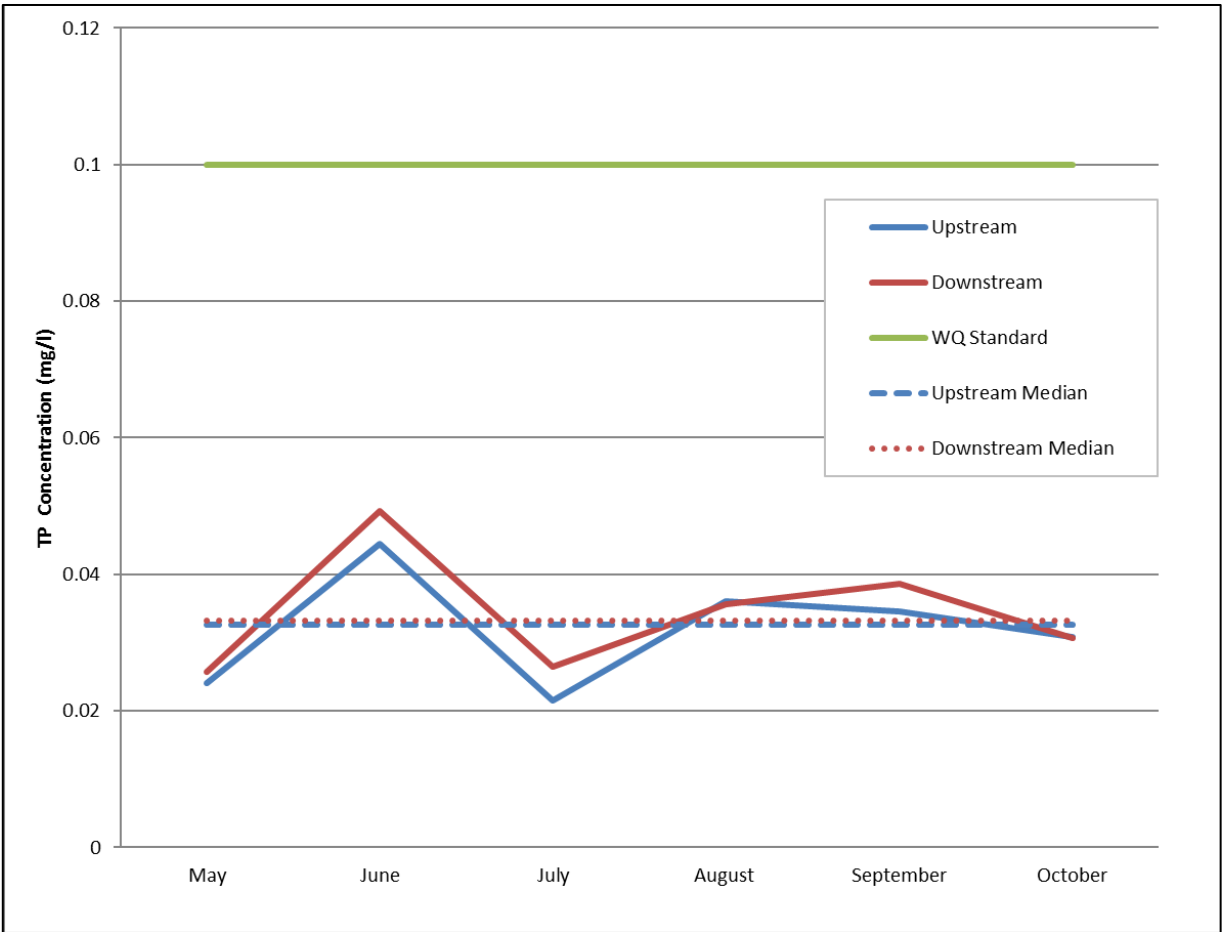


Figure 14 Median Total Phosphorus Upstream and Downstream of Balsam Row Dam (2016)

Phosphorous and Nitrogen: There were no defined spatial or temporal patterns in Total nitrogen and nitrate-nitrite Nitrogen concentrations within the Study Area. Total phosphorous (Figure 14), orthophosphate, and ammonia-N (Figure 15) increased slightly at the downstream monitoring location. It is not unusual for deeper impoundments to cause an increase in the concentrations of these parameters due to the presence of anoxic conditions. However, it is unlikely that anoxic conditions develop and persist in the Balsam Row Pond based on its morphology, short hydraulic retention time,

and depth. It is more likely that external nutrient sources from within the watershed contributed to the increase concentrations observed at the station locations.

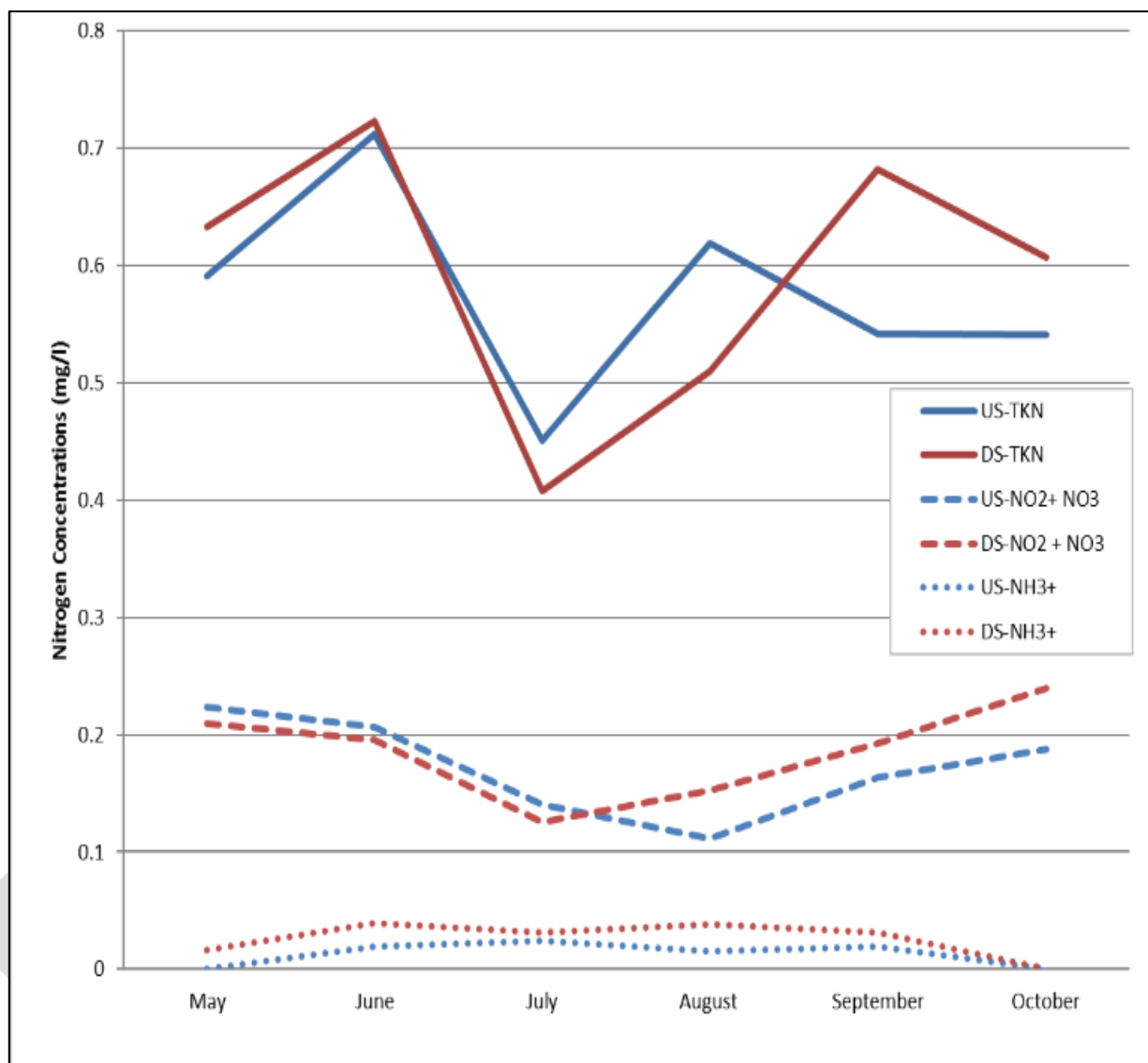


Figure 15 Nitrogen Series Concentrations Upstream and Downstream of Balsam Row Dam (2016)

Dissolved Oxygen (DO): DO concentrations were collected at a single point in time during the grab sampling for other water quality parameters. A consistent pattern of lower DO concentrations was observed at sample site B averaging 1.3 mg/l lower at the downstream sample station. However, the DO concentration was never observed to fall below the DO water quality criteria standard of 5 mg/l. The lower DO concentration could be attributed to hydrological differences in the sampling locations; sample station A was located downstream of a riffle which provided thorough mixing and oxygenation

of the surface water, whereas sample station B was below the Balsam Row dam and not in close proximity to a riffle.

Temperature: Monthly and maximum daily average temperatures followed a consistent pattern with the downstream monitoring location being 0.4- 0.5 degrees warmer than the upstream monitoring station. This minor difference in temperature is likely due to the larger surface area of the Balsam Row Pond exposed to solar radiation and warm air. Continuous temperature readings at both stations indicated that surface water temperatures were below the ambient temperature criteria for warm large rivers in June, July, and August (Table 11).

Table 11 Average Temperature Data for the Wolf River Upstream and Downstream of the Balsam Row Dam

Site	June	July	Aug	Max Daily
STH 47	20.69	22.92	22.78	26.22
CTH A	21.09	23.38	23.26	26.73

Water chemistry parameters could be different in various sections of the Wolf River. Reasons for these differences include:

1. The impoundment may have reached equilibrium with sediment storage capacity allowing continual transport downstream. This may not explain an increase in TSS downstream of the dam unless the sediment capacity within the impoundment has been exceeded in which case a net increase of sediment transport out from behind the Balsam Row dam is occurring. It could be hypothesized that sediment deposited in the depositional reach and impoundment from the failure of the Keshena Dam in 1972 is continuing to scour and sending an increase of sediment load downstream.
2. It could be hypothesized that operation of the dam may cause episodic releases of stored sediment behind the dam and sampling events happened to coincide with these releases.
3. The months of May and October were periods where TSS decreased in the downstream sample and sediment may have settled within the impoundment. Alternatively, during the months of June, July August, and September, warmer temperatures lead to increased recreational boating activity. It could be hypothesized that during the warmer months, TSS suspension and transport is correlated to recreational boating activities and during the remainder of the year sediment settles within the impoundment.
4. There could have been a series of bank failures upstream of the downstream monitoring location that contributed to a seasonal occurrence of increased total suspended solids observed downstream. This occurrence is less likely since no significant bank failures were observed during the 2016.
5. Common Carp are present below the Balsam Row Dam and suspension of solids is due to their presence.

6. The impoundment upstream of the dam could increase algae or free-floating plants (Duckweed) production and the increase in TSS could be in the form of organic suspended solids rather than particulate sediment. Typical trends in plant and algae growth contributions to TSS would occur in the warmer months. This hypothesis could be checked by collecting additional water quality samples for Chl A, TSS, and VTSS to achieve an understanding if the increase in seasonal TSS observed during the summer is from sediment transport versus algae or plant material transport.

Appendix H: Habitat Survey

Introduction: The Study Area has seen alterations since the 1800's from a long history of logging, agriculture, hydrologic modifications and other human influences. The evaluation of available habitat within the Study Area, including along with tributary streams, provides important ecological context for interpretation of the biological data in the Study Area.

There are five distinct habitats within the Study Area (Figure 16). From Keshena Falls downstream they include:

- The Rocky Reach extending from the base of Keshena Falls to Fair Grounds Road and is 1.72 miles of river length.
- The depositional reach extends from Fair Grounds Road to approximately the Menominee County Line and is about 1.87 miles of river length.
- The Balsam Row Pond is an 85-acre impoundment of the Wolf River upstream of the Balsam Row Dam. It extends from approximately the Menominee County Line to the face of the Balsam Row Dam.
- The riverine reach downstream of the Balsam Row Dam is short in distance covering only about 1.5 miles of river length, extending from the Balsam Row Dam downstream to the reach impounded by the Shawano Paper Mill Dam. The upper ¼ mile is wadable and the lower 1.25 miles is non-wadable.
- The Wolf River Pond is a 305-acre impoundment of the Wolf River above the Shawano Paper Mill Dam.

Survey Area and Methods: Habitat was evaluated from Keshena Falls to the Shawano Paper Mill Dam. Habitat evaluations occurred at all stations except the Wolf River, following the qualitative habitat evaluation approach (modified Simonson et al. 1994; WDNR 2007). No Department standardized protocols exist for assessment of non-wadable large rivers. Documentation of habitat characteristics were collected at sample stations which included bank erosion, riparian buffer width and condition, bottom substrate, river feature, aquatic plants, and fish cover.

The depositional reach and rocky reach are both located above the Balsam Row Pond and were identified in the field, and further defined by referencing the Fitzpatrick 2005 USGS Report.

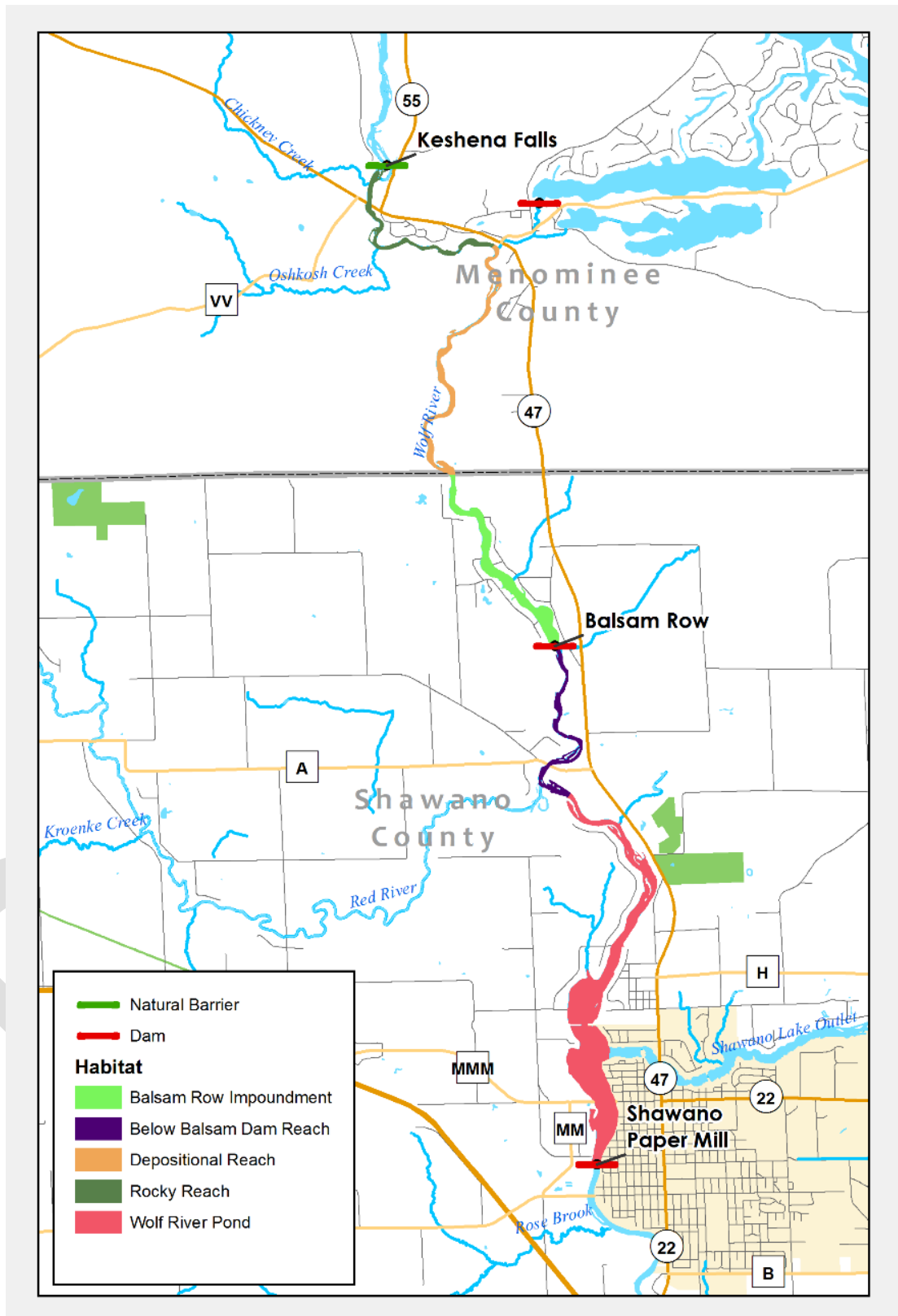


Figure 16 Locations of Habitat Sections Identified During the 2016 Field Surveys

Results:

Rocky Reach - The sinuosity within the rocky reach is 1.55 and has a gradient of 8.3 feet per mile. The riparian corridor consists of a mixed age white pine forest. This area is slightly more developed than that of the depositional reach. Bank erosion is limited. The dominant river feature throughout this reach is riffle. However, a few pools and segments of run exist. The mean depth throughout the reach is 1-4 feet with a few pools reaching 6-7.7 feet in depth. The bottom substrate is dominated by cobble, boulder, gravel, and sand. Along the stream margins and throughout the shallow runs and riffles, boulder habitat is present. Along the stream margins coarse woody debris and both emergent and submergent vegetation are present. Two surveyed tributaries enter the Wolf River in this reach.

- Oshkosh Creek is a small 4-meter-wide stream that has good habitat that scored 73 out of a possible 100. Abundant fines and lack of pools were identified, lowering the overall habitat score. Oshkosh Creek has a sinuosity of 1.85 and a gradient of 39.3 feet per mile.
- Chickney Creek is a small 13-foot wide stream that has excellent habitat that scored 92 out of a possible 100. Chickney Creek has a sinuosity of 1.59 and a gradient of 30 feet per mile.

The diversity of riverine features in the rocky reach provides greater habitat complexity within the Study Area than the depositional reach and the Balsam Row Pond. The two tributaries that enter the Wolf River within this reach provide habitat and seasonal usage by Wolf River species. Submergent vegetation is limited to depositional areas along the river margins and backwater sloughs within this reach.

Depositional Reach - The sinuosity within the depositional reach is 1.33 and has a gradient of 1.7 feet per mile. The riparian corridor for this section is undeveloped with the exception of a few locations near Fair Grounds Road. Well established mixed age white pine forest vegetation provides good bank stability. Limited bank erosion was observed where steep banks exist along outside bends. Little to no erosion existed elsewhere along the banks. The river feature is consistent throughout this reach as a run. However, a few deep pools exist on outside bends near Fair Grounds Road. The mean depth throughout this reach is 2-4 feet with a deeper pool reaching 8.9 feet in depth. The substrate throughout the reach is dominated by sand. Silt and detritus are common along the stream margins, point bars, and backwater sloughs. Sand and gravel with limited cobble comprise the area swept by the swiftest current in the upper area of the reach near Fair Grounds Road. Along the stream margins and backwater sloughs, Wild Rice beds and Purple Loosestrife with other emergent plant species are common. The open water margins of these backwater and stream margin areas support dense plant beds of lilies, Water Celery, and native pondweeds. Coarse woody debris is present along the margins and sparse woody cover and submergent vegetation exists throughout the center channel areas to provide cover for fish. Only one tributary enters the Wolf River in this section.

- Keshena Creek is a small 10-foot-wide stream that originates as the confluence of the outlets for Legend Lakes and Keshena Lake, within the MITW Reservation. A flood control structure exists at the confluence of Keshena Creek. During spring freeze and thaw ice conditions, stop logs are placed within the structure to prevent flood waters from backing up into Keshena Creek and flooding the intersection of STH 47/55 and Fair Grounds Road. Keshena Creek enters the Wolf River 262 feet downstream of Fair Grounds Road. Keshena Creek has a sinuosity of 1.1 and a gradient of 2.66 feet per mile. Based on water temperature and flow, Keshena Creek is a cool-warm mainstem that provides good habitat and seasonal usage by Wolf River species. Various mussels and their host species were observed in Keshena Creek. Habitat scored “good” with a score of 58 out of a possible 100. Scores were lower within the sample station due to minimal buffer width, an abundance of fines, and monotonous habitat from historical straightening.

Per a USGS report, it appears that most of the sand deposited in the depositional reach resulted from the impounding effects of the Balsam Row Dam. The origin of the sand comes from a combination historic logging operations, and increased during or after the failure of the Keshena Falls Dam in 1972 (Fitzpatrick 2005). This deposition has created limitations to habitat.

Balsam Row Pond – Balsam Row Pond is an 80-acre impoundment that is relatively narrow and riverine in appearance and reaches a maximum depth of 14.1 feet with a mean depth of 5.2 feet. Bottom substrate consists mostly of fine sand, silt and clays with pockets of organic deposits. Some areas of exposed gravel exist but are limited. The fine sediment deposited within the Balsam Row Pond extends up to the Menominee County line and covers the original substrate of cobble and gravel (Fitzpatrick 2005). The maximum rooting depth of aquatic plants is 7.9 feet and the littoral zone is minimized by the narrow riverine nature of the pond. Habitat within the pond is comprised of submergent and emergent aquatic plant beds and coarse woody debris.

The upper portion of the pond contains a greater littoral edge of emergent vegetation while the lower portion of the pond contains a greater submergent vegetation component. The upper portion of the pond also contains coarse woody habitat along the shoreline. and more riverine features that have developed and can be observed such as point bar deposits and back water sloughs. These areas within the upper pond begin to support a diverse, mixed stand of emergent vegetation that contains Wild Rice. As you travel upstream, these areas become larger and better defined, and contain greater amounts of Wild Rice. Approximately 67% of the shoreline within the Balsam Row Pond is developed. However, there may be impounding effects up as far as Kittecon Road based on the dynamic change in fish community near the Menominee County line.

Riverine Reach Below Balsam Row Dam- The riverine reach downstream of the Balsam Row Dam is 1.5 miles long. In the upper 0.25-mile immediately below the Balsam Row Dam the Wolf River is wadable. The remaining 1.25 miles of river are non-wadable. Shoreline vegetation, tree drops and overhanging woody vegetation provide habitat features within this reach.

The upper 0.25 miles has a sinuosity of 1.33 and has a gradient of 1.36 feet/mile. The riparian corridor is generally undeveloped and well-established vegetation provides bank stability. Little to no bank erosion was observed. In this section the river is consistent with a riffle and fast run with a mean depth of 1-3 feet. The substrate is comprised of cobble, boulder and gravel, minimally embedded into coarse sand. Depositional fines are likely seasonally scoured and sorted by concentrated flows from the Balsam Row Dam. Aquatic plant communities consist of Water Celery and pondweeds along with various other emergent species along the river margins.

For the remaining 1.25 miles of this section, fine sand, silt, clay and detritus become the dominant substrates; especially along the stream margins, point bar deposits, and backwater sloughs. Submergent plant beds were sparse within the main channel but were present in backwater slough areas that were also dominated by White Water Lily and Spatterdock. Additional features consist of coarse woody debris and overhanging brush along the stream margins.

- Alcohol Creek enters the Wolf River 246 feet downstream of the Balsam Row Dam. It is a small 9.8-foot-wide stream with “good” habitat that scored 68 out of 100 using the wadable streams qualitative habitat rating protocols. The stream has a sinuosity of 1.33 and a gradient of 21 feet per mile. Habitat scores on Alcohol Creek upstream of STH 47 are lower due to a lack of pools, as a result of adjacent land use and hydrologic modifications including channel straightening, dredging, and constructed ponds. Alcohol Creek is likely seasonally used by some Wolf River fish species.

Wolf River Pond - Wolf River Pond is a 305-acre impoundment of the Wolf River created by the Shawano Paper Mill Dam. The pond is connected to Shawano Lake via the Shawano Lake Outlet. The Wolf River Pond is a maximum of 14.1 feet deep with a mean depth of 6 feet. Bottom substrate consists mostly of fine sand, silt and clays with pockets of organic deposits. Some gravel and cobble is present but usually associated with human influence such as rip-rap or access locations. The influence from the pond extends up to CTH A. The maximum rooting depth of aquatic plants is 7.9 feet within the pond. The littoral zone is minimized by the narrow riverine nature of the upper pond area. Habitat within the pond is comprised of mainly submergent aquatic plant beds. A few locations with native emergent vegetation exist but are limited to a few undeveloped areas, and random scattered pockets along the shorelines. During the summer months dense beds of Eurasian Watermilfoil and Curly-Leaf Pondweed can be seen topping out of the water and becoming densely overgrown, with filamentous algae and Duckweed forming surface mats. The northeast bay of the pond, upstream of the railroad crossing, is an area that contains large stumps. This area provides a habitat complex of coarse woody debris.

- An Unnamed Tributary to Wolf River Pond (WBIC 5012829) enters the bay in the northwest corner of the Wolf River Pond. This is a small 10-foot-wide stream that has “poor” habitat which scored 30 out of a possible 100 using the wadable streams qualitative habitat rating protocols. A narrow-disturbed buffer zone, monotonous habitat, poor width to depth ration, extensive fines, and lack of vegetative cover for fish, all severely impacted the overall habitat score. The Unnamed Tributary to Wolf River Pond has a sinuosity of 1.48 and a gradient of 41.3 feet per

mile. Currently it has poor riparian buffer width and quality, excessive build-up of fines, no cover for fish and is a monotonous habitat that is negatively impacting the Wolf River Pond.

Table 12 Habitat Ratings for Tributaries to the Wolf River Within Study Area

Stream - Site	Chickney Creek Oshkosh Road	Oshkosh Creek Kittecorn Road	Keshena Creek Hwy 47	UNT at Wolf River Road	Alcohol Creek Balsam Row Road	Red River Maple Ave
Stream Order	1	2	3	2	1	4
Stream Width (m)	4	4.0	3	3	3	15
Station Length (m)	140	140	105	105	105	400
Verified NC Classification	Cool Warm	Cool Warm Head Water	Cool Warm Main Stem	Cool Warm	Cool Cold Head Water	Large River
Habitat Rating	Excellent	Good	Good	Poor	Good	Excellent
Habitat Score	92	73	58	20	68	86

- The Unnamed Tributary (WBIC 5012787) and Unnamed Tributary (WBIC 5012829) converge above Wolf River Road and are both impacted by degraded habitat conditions from dredging, straightening, and agricultural land-use.
- The Red River enters the Wolf River Pond from the west, approximately 1000 feet downstream of CTH A. The Red River is a 49.2-foot-wide tributary with “excellent” habitat which scored 86 out of a possible 100 using the wadable streams qualitative habitat rating protocols. The Red River contributes significant flows to the Wolf River which adds diversity at the convergence of the river systems. It has a sinuosity of 1.69 and a gradient of 7.5 feet per mile in the lower 2.5 miles. Red River is likely significant interaction exists between species that reside within the Wolf River and the Red River.

Appendix I: Aquatic Insect Surveys

Introduction: The collection and assessment of the aquatic insects can provide valuable information for the comprehensive assessment of the Study Area within the Wolf River. The majority of aquatic insects have limited mobility serving as good indicators of local conditions as well as upstream watershed impacts. Various metrics and indices can be used to describe the condition of the aquatic insect community but in general as the environmental condition degrades, there is a loss of intolerant species and a gain in tolerant species.

Survey Area: Aquatic insect sample collection sites were designated at various locations throughout the Study Area.

- Non-wadable sample methods were used at the fixed monthly water chemistry monitoring locations located above the Balsam Row Dam just downstream of the footbridge adjacent to STH 47, and below the Balsam Row Dam at CTH A.
- The wadable samples were collected from various locations at representative habitats within the Study Area (Figure 17).

Methods: Aquatic insect samples were collected by multiple methods. At two locations, 3 eight-plate Hester-Dendy artificial substrate samplers were attached to a cinder block (Figure 20), placed in the river and allowed to colonize for a six-week period (Weigel and Dimick 2011). The samplers were then retrieved, insects collected, preserved and delivered to the UWSP-Aquatic Bio-monitoring Laboratory for identification to the lowest taxonomic level. Metrics were calculated for establishment of a Non-wadable Index of Biotic Integrity (IBI) score. Additional samples were obtained utilizing standardized wadable collection methods with a D-frame nets. Sites were selected to assess wadable stream IBI metrics (Hilsenhoff-HIBI, and Macroinvertebrate-MIBI) and specific identification for any threatened and/or endangered damselfly and dragonfly larval species.

To provide the greatest range of biotic index comparisons, habitat of upstream and downstream sample sites for non-wadable, wadable and random locations were selected based on similarity of habitat. The two upstream and downstream wadable samples were collected from swift rock riffle habitat and the Hester-Dendy samplers were placed within deep runs with similar water velocities, similar substrates, and within similar proximity to large coarse woody habitat. The random samples focused on overhanging vegetation and coarse woody debris as the preferred habitat for damselflies and dragonflies.



Figure 17 Locations of Aquatic Insect Sampling

Macroinvertebrate Index of Biotic Integrity: The MIBI is the standard macroinvertebrate index used for assessment purposes for determining a wadeable stream's aquatic health. The MIBI was developed to quantify the aquatic response to local and watershed-level disturbance, riparian condition and local habitat quality in a biologically meaningful way.

The Non-wadeable Index of Biotic Integrity is similar to the MIBI except this index is used to assess large, non-wadeable rivers. Non-wadeable rivers require a unique sampling approach using Hester-Dendy colonizing samplers in place of a traditional D-frame kick net sample.

Table 13 Wadeable Stream MIBI Threshold and Condition Category

Wadeable Stream MIBI Threshold	Condition Category
7.5-10	Excellent
5-7.49	Good
2.51-4.99	Fair
0-2.5	Poor

Table 14 Non-Wadeable River IBI Threshold and Condition Category

Non-Wadeable River IBI Threshold	Condition Category
>75	Excellent
50-75	Good
25-49	Fair
<25	Poor

Hilsenhoff Biotic Index: The Hilsenhoff Biotic Index (HBI) represents the average weighted pollution tolerance values of all arthropods present in a macroinvertebrate sample. The HBI measures the community's response to organic pollution, which results in decreased dissolved oxygen concentrations.

Table 15 HBI Score and Condition Category

HBI Score	Condition Category
0-3.5	Excellent
3.51-4.5	Very Good
4.51-5.5	Good
5.51-6.5	Fair
6.51-7.5	Fairly Poor
7.51-8.5	Poor
8.51-10	Very Poor

Mean Pollution Tolerance: The mean pollution tolerance value (MPTV) is a modified tolerance value of the HBI that reflects changes in the sum of the tolerance values of the taxon divided by the taxa richness. It is expected that as human based watershed influences and stressors increase the expected response is an increase in the MPTV of the site.

Species Richness: Species richness is a composition metric that provides a measure of the total number of taxa. As human based watershed influences and stressors increase the expected response is a decrease in species richness as the most sensitive species are locally extirpated.

Comparing the HBI and MIBI scores between the two locations show the scores upstream of the Balsam Row Dam are slightly better than below the dam, but both scores indicate excellent water quality conditions (Table 16). The minor differences between the scores may be due to the presence or absence of one or two sensitive species found at one of the sample locations or a difference in the relative abundance of other species found at both locations.

Mean pollution tolerance values are lower upstream of the Balsam Row Dam when considering both the non-wadable and wadable samples. The difference between the scores is negligible. It is unknown what factors may account for the slight difference.

Table 16 2016 Aquatic Insect Sampling on the Wolf River Above and Below the Balsam Row Dam

	Non-wadable Protocol Sites		Wadable Protocol Sites	
Stream-Site	Downstream Balsam Row Dam	Upstream Balsam Row Dam	Downstream Balsam Row Dam	Upstream Balsam Row Dam
Non-Wadeable IBI Rating (Score)	65 (Good)	85 (Excellent)	NA NA	NA NA
Wadeable MIBI Rating (Score)	NA NA	NA NA	8.49 (Excellent)	9.67 (Excellent)
HBI Score	5.46 (Good)	4.55 (Good)	4.18 (Very Good)	3.56 (Very Good)
%EPT	52	41	65	48
Mean Pollution Tolerance Value	5.5	4.7	3.7	4.3
Species Richness	34	41	46	34

% EPT: The percent EPT is a composition metric that identifies the proportion of a sample that is comprised of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Tricoptera), which are generally considered the groups most intolerant to environmental degradation. This metric would likely decrease as instream and watershed environmental stressors increase.

There were several EPT found in samples from sites upstream of the Balsam Row Dam which were not found, or rarely found downstream. Specific species within these insect orders have low pollution tolerance values and are considered intolerant species. Many of the EPT species are observed

in very low abundance and it is not uncommon for only a single individual of a species to be identified within a sample. The slight differences in metrics between the sampling locations may be a function of some variability of the habitat sampled rather than impact of the Balsam Row Dam. Even with the intent to sample and compare similar habitats above and below the Balsam Row Dam, there were slight variations in the habitat sampled. These differences may explain species and metrics variability between the upstream and downstream scores and comparative metrics.

Overall, the insect communities and biotic metrics were very similar both above and below Balsam Row Dam and were indicative of good to excellent water quality. Consequently, the Balsam Row Dam does not appear to influence the aquatic insect communities above and below the dam.

Appendix J: Aquatic Plants Surveys

Introduction: Aquatic plants form the foundation of healthy lake and river ecosystems. They not only protect water quality, but also produce life-giving oxygen. Aquatic plants are a lake's own filtering system, helping to clarify the water by absorbing nutrients like phosphorus and nitrogen. Aquatic plants also stabilize soft lake bottoms and prevent shoreline erosion by reducing the effect of waves and currents. Healthy native aquatic plant communities may also help prevent the establishment of invasive non-native plants. Native aquatic plants also provide important reproductive, food, and cover habitat for fish, invertebrates, and wildlife.

Survey area: The Balsam Row Pond aquatic plant survey covered 84.9 acres (34.3 ha) and included the area upstream of the Balsam Row Dam up until the Shawano/Menominee County line. The Wolf River Pond survey covered 212.7 acres (86.1 ha) and included the area which the Wisconsin DNR open water GIS hydrolayer delineates. This area encompasses water upstream of the Shawano Dam, and stops at the Shawano Lake Outlet to the east, and the more riverine sections of the Wolf River to the north (Figure 19).

Survey Methods: Aquatic plant surveys were conducted following a grid-based point-intercept approach (Madsen 1999; Hauxwell et al. 2010), which has been shown to be appropriate for comparative studies (Mikulyuk et al. 2010). Aquatic plant presence/absence, sediment type and water depth were evaluated at each site on a georeferenced sampling grid. Grid spacing resolutions were based on the equations given in Mikulyuk et al. 2010 and resulted in 391 points on Wolf River Pond (137.8 feet between points) and 339 points on Balsam Row Pond (105 feet between points).

At each site, a double-headed rake (1.1 feet wide, 14 tines per head) on an adjustable pole was lowered vertically through the water column to the sediment surface, rotated twice, and then lifted straight up and out of the water. Plants retrieved on the rake, as well as plant fragments detached from the bottom were identified to species level following Crow and Hellquist (2000a, 2000b). An overall qualitative rake fullness rating was given at each site (Figure 18 & 19) and each individual species was also given a rake fullness rating.

Surveys were conducted in mid-summer to most accurately assess both native and non-native plant frequencies. However, the invasive plant Curly-Leaf Pondweed typically emerges in early spring and oftentimes dies back by mid-summer, so the presence and abundance of this species may be better captured by earlier season surveys.

The aquatic plants survey data was utilized to determine lakewide summary statistics, including:

- Maximum aquatic plant rooting depth: Depth of the deepest site sampled at which aquatic plants were present.

- Littoral frequency of occurrence: Number of sites that plants were recorded at divided by the total number of sites sampled that were shallower than the maximum depth of plant colonization (“littoral area”).
- Individual species littoral frequency of occurrence: Number of sites an individual species was observed at divided by the total number of sites shallower than the maximum depth of plant colonization (“littoral area”).
- Individual species average rake fullness: Average mean rake fullness rating, ranges from 1-3.
- Average number of species per littoral site: Mean number of species (both native and nonnative) found at sample sites which were less than or equal to the maximum depth of plant colonization.
- Average number of native species per littoral site: Mean number of native species found at sample sites which were less than or equal to the maximum depth of plant colonization.
- Species richness: Total number of species observed (not including visual sightings).
- Species richness (including visuals): Total number of species observed including visual sightings (does not include additional species found during the boat survey).
- Species richness (including visuals and boat survey): Total number of species observed including visual sightings as well as additional species found during the boat survey.
- Simpson’s Diversity Index: A nonparametric estimator of community heterogeneity. The closer the Simpson Diversity Index is to 1, the more diverse the community.
- Floristic Quality Index (FQI) (FQI; Nichols 1999): Metric that evaluates the closeness of the flora in a lake to that of an undisturbed condition. The higher a FQI value, the closer that plant community is to an undisturbed ecosystem. Includes both species found on the rake as well as visuals.

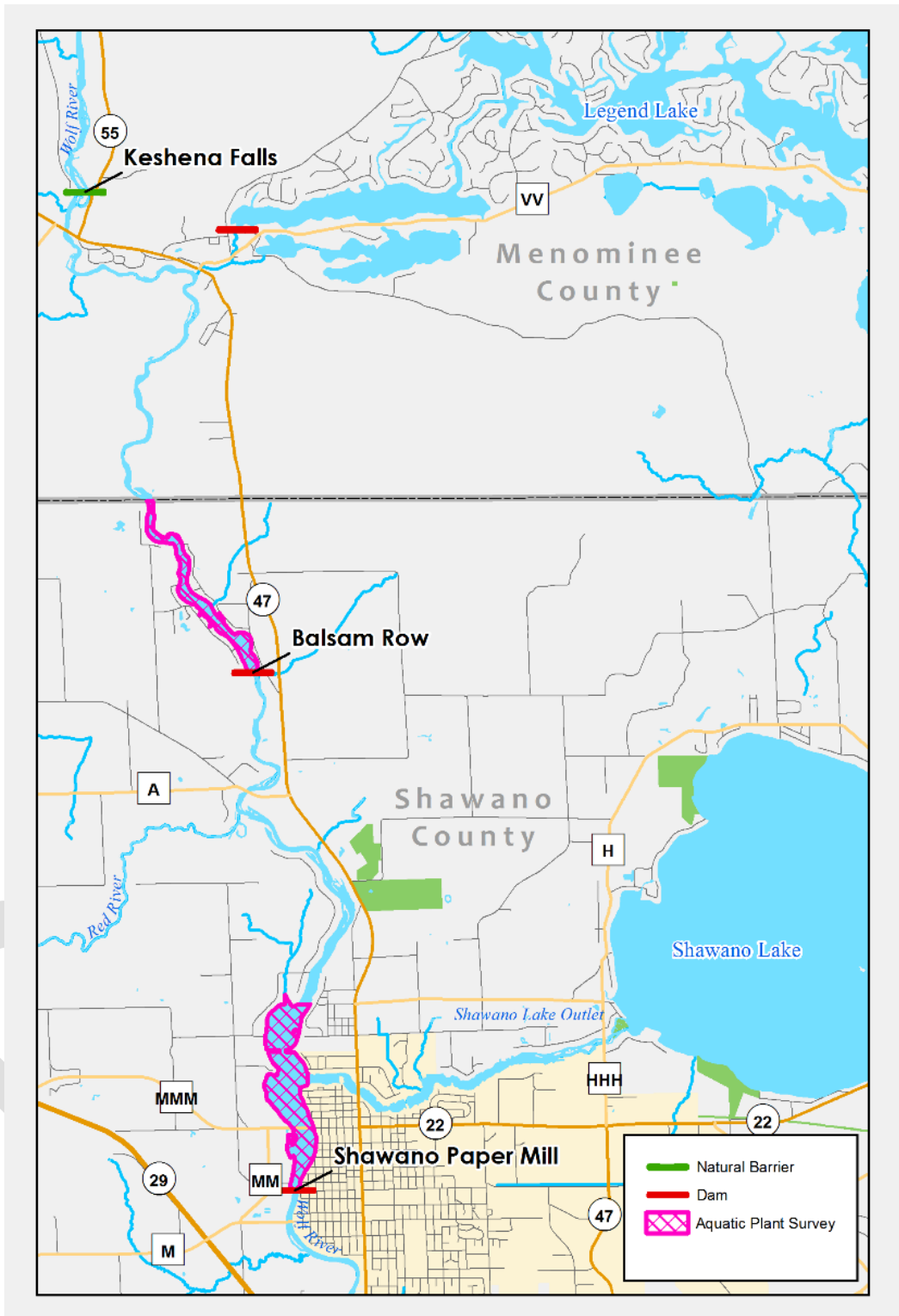


Figure 18 Areas Surveyed for Aquatic Plants Utilizing the Point-Intercept Methodology




Rake Fullness 1	Rake Fullness 2	Rake Fullness 3
Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer	There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.	The rake is completely covered, and tines are not visible
		

Figure 19 Rake Fullness Rating Used During the Aquatic Plant Surveys

Early Detection Monitoring (EDM) in Lakes protocol (WDNR 2017) was also used to survey for AIS. The EDM involves surveying all public boat landings for AIS, in addition to five targeted sites and a lakewide meander survey. At each sampling location, AIS were assessed by visual observations, D-nets, rakes, and snorkeling (where conditions allow). Presence/absence of each species was recorded, as well as a relative abundance rating.

In addition, observations were made at the deep hole using a 64-micron mesh plankton net to look for Zebra mussel veligers. Sediment samples were taken using an Ekman dredge at the deep hole to look for Spiny Waterflea presence/absence.

Balsam Row Pond Plant Survey Results: Of the 339 sample sites established on Balsam Row Pond, 293 sites were able to be accessed via boat, while other sites were not able to be accessed due to shallow water or dense emergent vegetation. Of the 293 sites sampled, 270 of them (92%) were determined to be less than or equal to the maximum aquatic plant rooting depth of 8.0 ft. Within this littoral zone, 65 of the 270 sites contained aquatic plants (24.1%). Although the maximum rooting depth of plants was recorded at 8 feet, the majority of plants grew in shallower waters between 1-4 feet deep. The sediment composition observed during the survey was sand (63%), muck (33%), and rock (4%).

For Balsam Row Pond, the Simpson Diversity Index was 0.82 (on a scale from 0-1, with 1 being the most diverse). The average number of native species per site was 0.42. Species richness of plants found on the rake was 8, and when including additional species found as visuals or during the boat survey was 17. The lakewide FQI for plants was 16.7. Species given a value of “Visual” were seen within 6 feet of the sample site but were not retrieved on the rake. “Boat survey” species were noted but not detected at a sample site on the rake or as a visual.

Table 17 Aquatic Plant Survey Summary by Species for Balsam Row Pond and Wolf River Pond, * = NR listed species

Common Name	Growth Form	Balsam Row Pond		Wolf River Pond	
		% Littoral Frequency	Average Rake Fullness	% Littoral Frequency	Average Rake Fullness
Wild celery	Submerged	10.7	1.3	15.9	1.3
Flat-stem pondweed	Submerged	9.3	1.2	20.9	1.0
Coontail	Submerged	7.8	1.2	32.9	1.2
Common waterweed	Submerged	5.6	1.5	36.8	1.2
White water lily	Floating-leaf	4.8	1.2	3.1	1.0
Northern wild rice	Emergent	2.2	1.2	Visual	n/a
Bur-reed	Emergent	1.1	1.0	0.4	1.0
River bulrush	Emergent	0.4	1.0	-	-
Sedge	Emergent	Visual	n/a	-	-
Small duckweed	Free-floating	Visual	n/a	19.8	1.0
Northern watermilfoil	Submerged	Visual	n/a	1.6	1.0
Eurasian watermilfoil*	Submerged	Visual	n/a	29.8	1.1
Whorled water-milfoil	Submerged	-	-	0.8	1.5
Arrowhead	Emergent	Visual	n/a	-	-
Softstem bulrush	Emergent	Visual	n/a	-	-
Large duckweed	Free-floating	Visual	n/a	5.4	1.0
Narrow-leaf cattail*	Emergent	Visual	n/a	-	-
Purple loosestrife*	Emergent	Boat Survey	n/a	Boat Survey	n/a
Common watermeal	Free-floating	-	-	20.2	1.0
Forked duckweed	Free-floating	-	-	17.4	1.0
Stonewort	Submerged	-	-	12.0	1.3
Southern naiad	Submerged	-	-	6.6	1.1
Fern pondweed	Submerged	-	-	5.0	1.1
Curly-leaf pondweed*	Submerged	-	-	4.3	1.0
Water star-grass	Submerged	-	-	4.3	1.2
White-stem pondweed	Submerged	-	-	1.6	1.0
Large-leaf pondweed	Submerged	-	-	1.6	1.0
Whitewater crow foot	Submerged	-	-	1.6	1.0
Spatterdock	Floating	-	-	1.2	1.0
Clasping-leaf pondweed	Submerged	-	-	0.8	1.0
Muskgrass	Submerged	-	-	0.4	1.0
Variable pondweed	Submerged	-	-	0.4	1.0
Water horsetail	Emergent	-	-	Visual	n/a

Wolf River Pond Plant Survey Results: Of the 391 sample sites, 337 sites were able to be accessed via boat, while other sites were not able to be accessed due to shallow waters or dense floating or

submerged vegetation. Of the 337 sampled, 258 of them (77%) were determined to be less than or equal to the maximum depth of plant colonization (8.0 ft). Within this littoral zone, 163 of the 258 sites contained aquatic plants (63.2% littoral frequency of occurrence). Although the maximum rooting depth of plants was recorded at 8 ft, the majority of plants grew between 1-6.5 ft deep. The sediment composition observed during the survey was muck (89%), sand (8%), and rock (3%).

Table 18 Aquatic plant survey summary statistics. Results are presented together but care should be taken not to compare the ponds to each other given their very different hydrologic and physiologic characteristics.

Aquatic Plant Survey Summary Statistic	Balsam Row Pond	Wolf River Pond
Maximum depth of plant colonization (ft)	8.0	8.0
Littoral frequency of occurrence (%)	24.1	63.2
Average number of species per littoral site	0.42	2.46
Average number of native species per littoral site	0.42	2.12
Species Richness	8	25
Species Richness (with visuals)	16	27
Species Richness (with visuals & boat survey)	17	28
Simpson's Diversity Index	0.82	0.91
Floristic Quality Index	16.7	30.6

Appendix K: Aquatic Invasive Species Surveys

Introduction: Aquatic invasive species (AIS) are a threat to Wisconsin lakes and rivers both ecologically and economically. Invasive species are problematic because their population can grow to nuisance levels, which often have a negative impact on native species because they are able to out-compete them for available resources needed for survival.

Survey area: The Balsam Row Pond aquatic invasive species survey covered 84.9 acres (34.3 ha) and included the area upstream of the Balsam Row Dam up until the Shawano/Menominee County line. The Wolf River Pond survey covered 212.7 acres (86.1 ha) and included the area which the WDNR open water GIS hydrolayer delineates. This area encompasses water upstream of the Shawano Dam, and stops at the Shawano Lake Outlet to the east, and the more riverine sections of the Wolf River to the north.

Methods: We conducted lakewide aquatic invasive species surveys following the Wisconsin DNR's Aquatic Invasive Species Early Detection Monitoring in Lakes protocol. This protocol involves surveying all public boat landings for AIS, in addition to five targeted sites and a lakewide meander survey. At each sampling location, AIS were sampled for by using visual observations, D-nets, rakes, and snorkeling. Presence/absence of each AIS was recorded, as well as a relative abundance rating. In addition, zooplankton samples were collected at the deep hole using a 64-micron mesh plankton net in order to look for Zebra mussel veligers. Three separate veliger samples were collected on Wolf River Pond in order to examine spatial distribution within the waterbody, while one composite sample (three tows combined) was collected on Balsam Row Pond. Sediment samples were also taken using an Ekman dredge at the deep hole in order to look for spiny waterflea presence/absence. Specific sampling locations for AIS on Balsam Row Pond and Wolf River Pond can be found in Figure 20.

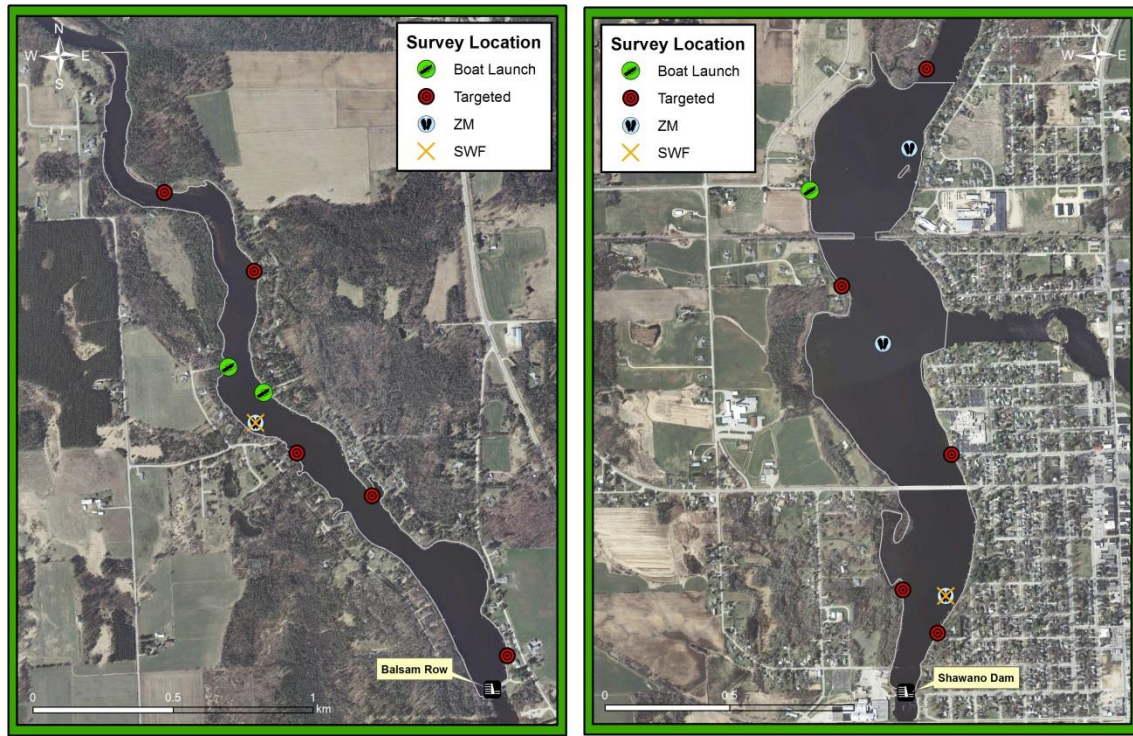


Figure 20. Locations of AIS Sample Sites for Balsam Row (left) and Wolf River Pond (right)

Balsam Row Pond AIS Results: AIS found in the Balsam Row Pond consists of Eurasian Watermilfoil, Rusty Crayfish, Chinese Mystery Snail, Narrow-Leaf Cattail, Purple Loosestrife, and Aquatic Forget-Me-Not. Plankton samples collected for Zebra mussels veligers were negative. Sediment samples collected for Spiny Waterfleas were also negative. Rusty Crayfish and Chinese Mystery Snails were abundant at the majority of sites surveyed. Eurasian Watermilfoil was noted in a small, localized area, and was not abundant throughout the waterbody.

There was no evidence of Curly-Leaf Pondweed or their turions within Balsam Row Pond. Eurasian Watermilfoil was very sparse (littoral % frequency = 0%; with 5 visual observations noted at locations near our survey points). This strain of Eurasian Watermilfoil may be different than the strain observed in the Wolf River Pond.

Wolf River Pond AIS Results: Watermilfoil, Chinese Mystery Snail, Narrow-Leaf Cattail, Purple Loosestrife, Aquatic Forget-Me-Not, Banded Mystery Snail, and Curly-Leaf Pondweed. Zebra Mussels and Rusty Crayfish have been previously reported (and verified) but none were observed during this survey. Plankton samples collected to look for Zebra Mussels veligers were negative. Sediment samples collected to look for Spiny Waterfleas were also negative.

Curly-leaf Pondweed is an early season (spring/early summer) species which typically dies back by mid-summer, and so the late July survey timing is probably not an ideal time to be looking for this species.

Nevertheless, we did observe Curly-Leaf Pondweed turions (vegetative reproductive structures) and a few live plants in Wolf River Pond.

Some species like Eurasian Watermilfoil were relatively abundant in the Wolf River Pond (littoral % frequency = 25%). This strain of Eurasian Watermilfoil may be different than the strain observed in Balsam Row Pond.

Appendix L: Freshwater Mussel Surveys

Introduction: Freshwater mussels are ecologically important in many ways; as a source of food to animals, fish and birds; as biofilters, siphoning many gallons of water a day, they provide nutrient and energy cycling in streams and lakes by filtering algae, bacteria, and organic matter from the water column providing nutrients to many other organisms (Vaughn and Hakenkamp 2001). Mussels provide structural habitat for other organisms and have been shown to significantly increase density of other macroinvertebrates (Vaughn and Spooner 2006). Mussels have also been reported to help stabilize sediments within mussel beds (Strayer et al. 2004).

Survey Area: Freshwater mussels were sampled at four sites within the Study Area. Balsam Row 2 (BR2) was the most downstream site, Balsam Row 1 (BR1) was located approximately 328 feet below Balsam Row Dam, Upper Balsam (UB) was located at the upstream end of the Balsam Row Pond, and the last site was located just downstream of Keshena Falls (KF) (Figure 21).

Methods: In 2014, qualitative searches were conducted at BR1, and UB; and in 2016 at Keshena Falls. Sites were searched for four-person hours (2 persons/2 hrs each) or a minimum of 656 feet. Divers used snorkel and/or scuba gear to collect live mussels. All live mussels were identified to species and counted. Mussels were aged into two groups, less than 4 yr or 4 plus to determine if there was any reproduction occurring. For those species in which live specimens were not found but dead shells were found, a shell was retained for later identification.

In 2016, quantitative sampling was conducted at BR1, BR2, UB, and KF using systematic random sampling with a double random start procedure. General habitat conditions for flow, substrate and macrophyte abundance were collected at each quantitative sampling site. Mussels were collected by divers within quadrat areas (2.69 ft sq. in size) using snorkel and/or scuba gear in deeper water. A total of 100 quadrats were surveyed for mussels at each site. Survey sites were 100 m in length by 33 m width and were divided into 10 segments, each 10 m in length. One transects line was placed perpendicular to river flow within each 10 m segment with a random start between 0 to 9 m. Mussels were surveyed along a 30 m transect line at 3 m intervals with a random start between 0 to 3 m from the ordinary low water line for a total of 10 quadrats per line (Figure 22).

Once the quadrat was placed, all mussels visible were collected and the quadrats were excavated to a depth of 2 inches by fanning and removing the substrate to reveal any additional mussels to be collected. All live mussels and dead shells were identified to species and counted, and the numbers of juveniles less than 4 years of age were recorded by species. Mussel density was calculated as number of live mussels/m² area sampled for all live mussels collected and by individual species (Washington 1984).



Figure 21. Location of Mussel Sampling for 2014 and 2016

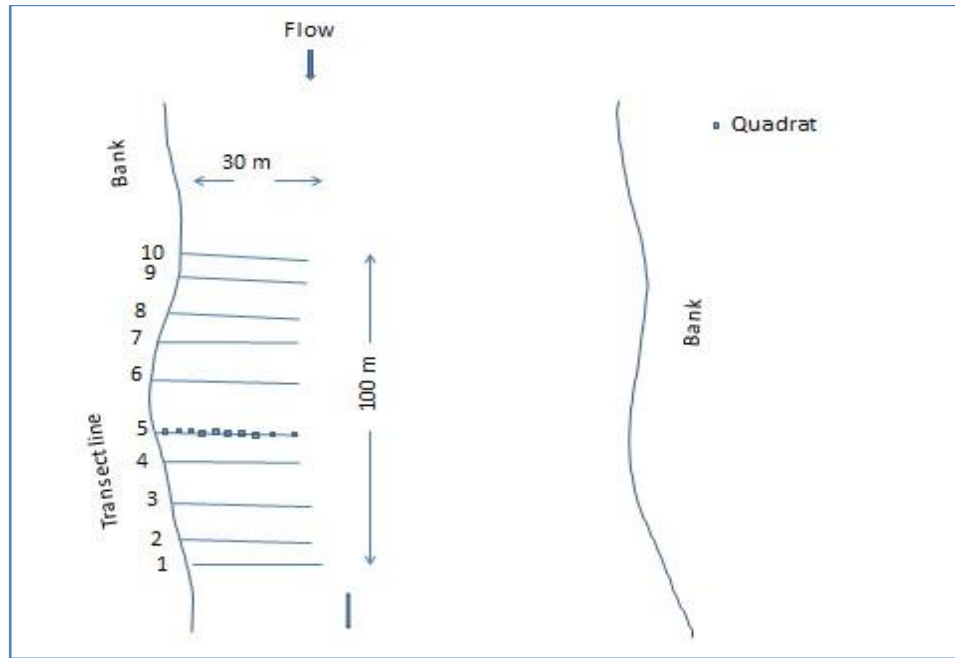


Figure 22 Representative Diagram of Quantitative Mussel Survey Site

Results: Combined qualitative and quantitative freshwater mussel sampling at four locations in the survey area collected 3,550 live individuals representing 12 native species (Table 19 & 20). Sampling collected 11 species below Balsam Row Dam and 12 species above Balsam Row Dam. The combined mussel sampling ranged from 9 -12 species per site. Nine species were found at all four sites with Spike being the most numerous species collected.

Overall mussel density was 50 percent less at the two sample locations above Balsam Row Dam, compared to the two sample locations between Balsam Row Dam and Shawano Paper Mill Dam. Mean mussel density averaged 17.6 mussels/m² at the sample locations below Balsam Row Dam compared to 8.9 mussels/m² at the sample locations above Balsam Row Dam. Mussel density ranged from 8.6 individuals/ m² at KF, to 18.16 individuals /m² at BR1 (Table 21). Spike were the most frequently collected mussel at all four sites comprising 72% (BR1) and 75% (BR2) of species composition during quantitative sampling below Balsam Row Dam, and 91% (UB) and 83% (KF) of species composition above Balsam Row Dam. Mean mussel diversity for quantitative sampling was 45 percent less at the sample locations above Balsam Row Dam.

Table 19 Number of Freshwater Mussels During Qualitative Surveys on the Wolf River [Number of Juveniles < 4 Years Old in Parenthesis].

SPECIES	Balsam Row 1 2014	Upper Balsam 2014	Keshena Falls 2016
Mucket	95	1	0
Slippershell	2	14	6

Elktoe Margarita	4 (1)	4	0
Cylindrical Papershell	0	1	2
Spike	668 (1)	654 (1)	402 (7)
Wabash Pigtoe	12	14	51
Fat Mucket	45	11	18 (2)
Plain Pocketbook	36 (2)	4	32 (2)
Fluted-shell	124	4	1
Black Sandshell	20	Dead shell only	1
Round Pigtoe	1	0	0
Creeper	13 (1)	17 (1)	23 (1)

Table 20 Number of Adult and Juveniles (in parentheses) Mussels and Density (#/m²), For Mussels Collected During Quantitative Sampling in 2016.

	Balsam Row 1		Balsam Row 2		Upper Balsam		Keshena Falls	
SPECIES	Number	Density	Number	Density	Number	Density	Number	Density
Mucket	28 (1)	1.16	45 (4)	1.96	0	0	0	0
Slippershell	0	0	1	0.04	2	0.08	4	0.16
Elktoe	2	0.08	2	0.08	Dead shell only	0	1	0.04
Spike	312 (18)	13.2	320 (3)	12.92	196 (10)	8.24	169 (10)	7.16
Wabash Pigtoe	0	0	8 (1)	0.36	4 (1)	0.20	10	0.40
Fat Mucket	23	0.92	16 (2)	0.72	13 (1)	0.56	11	0.44
Plain Pocketbook	14 (1)	0.60	2	0.08	Dead shell only	0	4 (2)	0.24
Fluted-shell	32 (1)	1.32	18	0.72	0	0	2	0.08
Black Sandshell	10	0.40	5	0.20	0	0	0	0
Round Pigtoe	2	0.08	0	0	Dead shell only	0	0	0
Creeper	10	0.40	1	0.04	1	0.04	2 (1)	0.12
Number of live adults	433	17.32	418	16.72	216	8.64	203	8.12
Number live < 4 yr old	21	0.84	10	0.40	12	0.48	13	0.52
Number of live species / Density of live mussels (m ²)	9	18.16	10	17.12	8	9.12	8	8.64

Juvenile mussels less than 4 years of age were observed for 8 species below Balsam Row Dam and 5 species above Balsam Row Dam. Juvenile mussels accounted for 2.4% of all individuals collected and juvenile density ranged from 0.40 to 0.84 juveniles / m² (Table 20). Spike juveniles were the most abundant, with 53 juveniles for quantitative and qualitative combined.



Figure 23 Darter using mussel shell as habitat

Mussel shell material was common at most of the site locations, providing additional habitat for other macro-invertebrates and small fishes (Figure 23). Mussel shells played an important part in providing hiding spaces for small fish species. Several Slenderhead Darters were observed inside dead mussel shells.

Visual observations of sample locations indicate suitable habitat exists for mussels within the Study Area and that there is similar habitat to locations where mussels have been observed below the Shawano Paper Mill Dam. General habitat conditions were observed in areas consisting of riffle/ run with depth averaging around two feet with moderate flows during the summer period. Substrates were predominately silt/ sand with smaller amounts of gravel and cobble with sparse to moderate density of macrophytes. BR1 and KF sites contained coarser substrate than BR2 and UB.

Table 21 Site Locations and General Habitat for Quantitative Mussel Surveys on the Wolf River.

	Balsam Row 1	Balsam Row 2	Keshena Falls	Upstream Balsam
Latitude	44.83	44.83149	44.890	44.8688
Longitude	-88.62	-88.62453	-88.65	-88.64486
River Width (ft)	219.0	183.7	128.0	98.4
Macro Habitat	Run/riffle	Run	Riffle	Run
Mean Depth (ft)	2.4	2.8	1.74	2.4
Mean Velocity (ft/sec)	1.31	1.31	0.66	0.66
Detritus	0	0	10	15
Clay	0	10	0	0
Silt	0	50	10	50
Sand	60	30	35	30
Gravel	15	0	10	5
Cobble	15	10	15	0
Boulder	10	0	20	0
Bedrock	0	0	0	0
Submerged Plants	20	70	5	5

Appendix M: Fish Community Assessment

Survey Area: Sampling to determine the overall fish community assemblage within the Study Area and assigning scores for the Index of Biotic Integrity (IBI) was completed throughout various areas of the Wolf River, Wolf River Pond, Balsam Row Pond, and tributaries of the Wolf River within the Study Area.

Methods: Various fish sampling methods and survey types were utilized to compile a species assemblage within the Study Area.

For the purpose of calculating the IBI for wadable streams standard WDNR sampling protocols were used (WDNR 2001). Wadable stations on streams were established at 35 times the mean stream width (modified from Simonson et al. 1994). Stations were no less than the minimum of 328 feet long and no more than the maximum of 1312 feet. A direct current electrofishing backpack shocker was used to collect all fish possible with an upstream pass through the sample station. All fish were collected, identified, and counted. All game fish were measured.

On August 25 and 26, 2016 fish community surveys using non-wadable sampling protocols were conducted at three sites on the Wolf River; one near Keshena, one above the Balsam Row Pond and one between the Balsam Row Dam and the Shawano Paper Mill Dam. (Figure 24). Stations were one mile in length. Standard large-river IBI sampling protocols were followed. Sampling was conducted in a downstream direction at 1.5 to 2 m.p.h. along the shoreline with a miniboom electroshocker (single boom, 8-12 droppers) with pulsed-DC (25% duty, 60 Hz) output to the water of approximately 3000 W and a single netter used a net with 17-mm stretch mesh (Lyons et al. 2001). The netter attempted to collect all fish observed. Captured fish were identified and counted. All fish captured were examined for deformities, eroded fins, lesions and tumors (DELT).

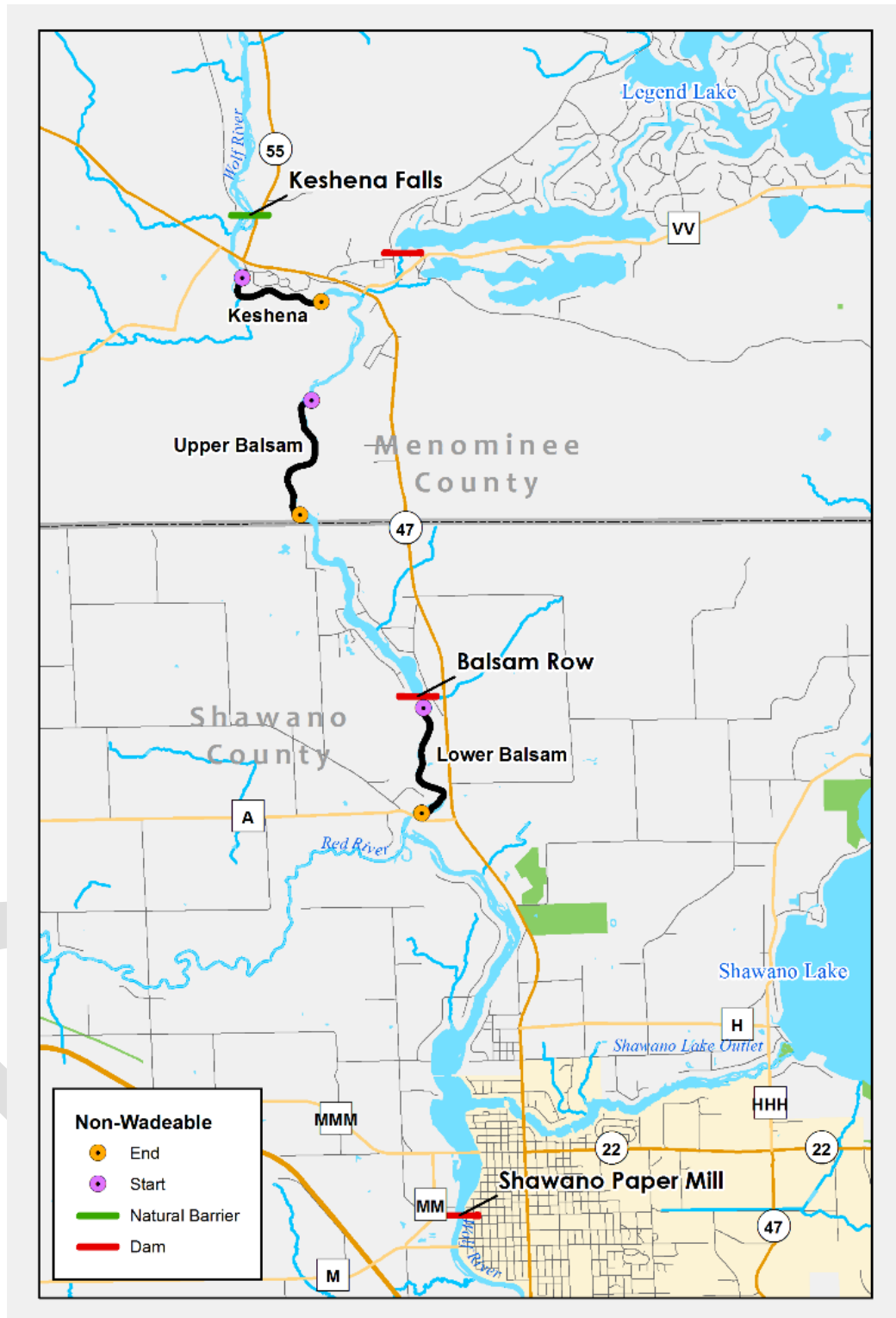


Figure 24 Non-wadeable IBI Sites on the Wolf River

The remainder of the fish community assemblage sampling was completed by seining efforts in various habitat types (Figure 25).

Two seine methods were used based on the habitat type sampled. In rocky or fast riffle areas, a 3x2-m seine with 6.4-mm delta mesh was set in place, substrate upstream was disturbed and fish were driven down into the net. In main channel areas where sand flats or vegetated margins existed, a 10x1.5-m bag seine with 6.4-mm delta mesh was pulled downstream with the current or from deep water into shallow water. One to six seine pulls were completed at each station and seine area was recorded. All captured fish were counted and identified, and all game fish lengths were recorded.

It is important to note that non-wadable fish sampling does not give a complete picture of the fish community in a large non-wadable river such as the Wolf River in that it only samples the flowing river channel and not additional side channels. Boat electrofishing is most effective for large-bodied fishes and tends to under sample small-bodied fishes but does give a representative sample of the riverine fish community by which to assess river health (Lyons 2001). Seining efforts were used to compliment and offset the ineffectiveness of boat electrofishing on smaller bodied fish and other available habitats not sampled during the non-wadable surveys. Seining also has its limitations that affect and may limit collection of an entire fish community, but it was expected that with these two methods the best representation of the fish community was surveyed.

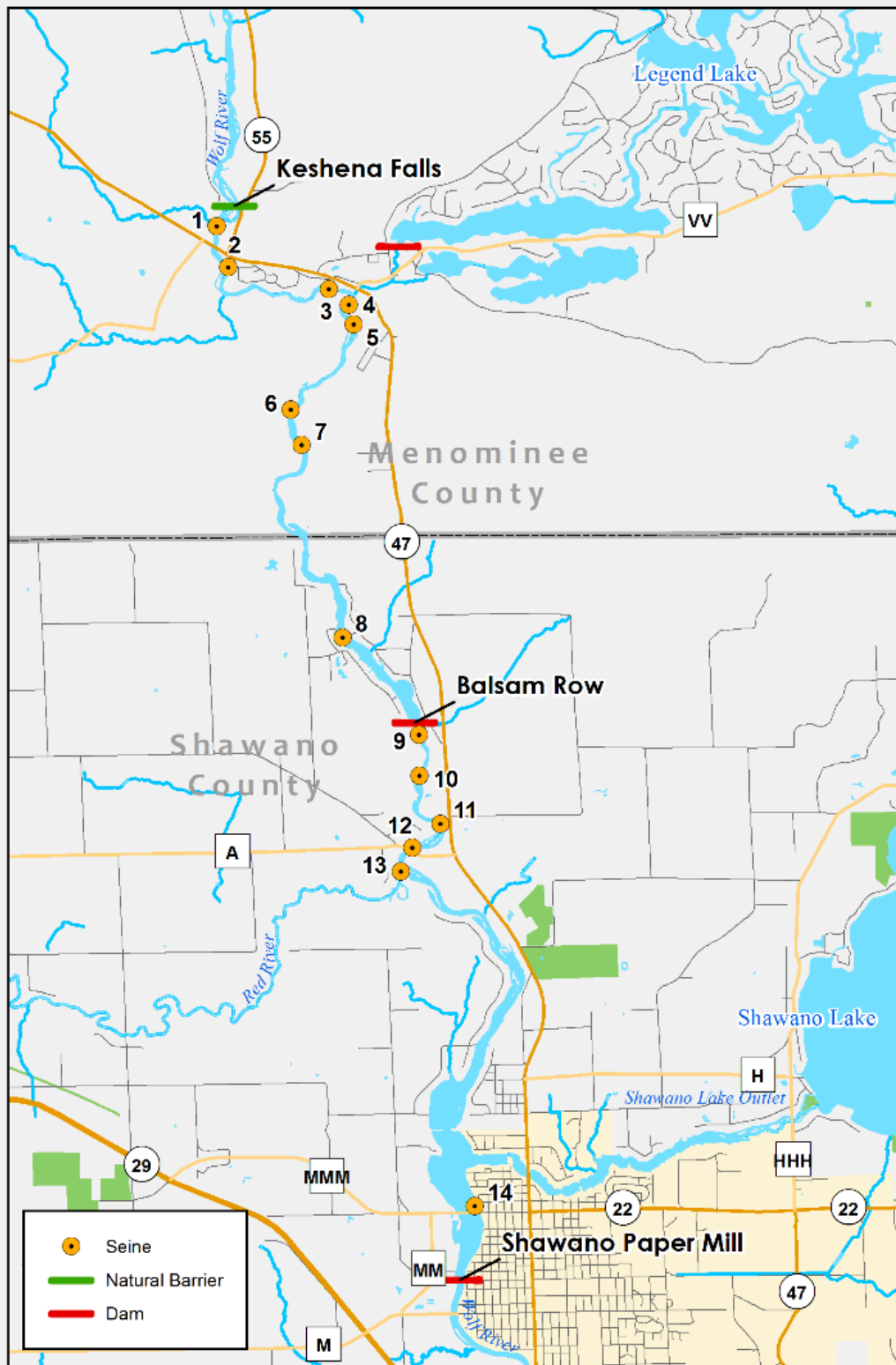


Figure 25 Seine Locations on the Wolf River

Wolf River Non-Wadable Survey Results: Non-wadeable fish sampling captured 730 individuals representing 26 species, weighing a total of 297.9 lbs. No threatened or endangered fish species were captured, 11 species were considered riverine specialists and 7 species were considered intolerant of environmental degradation. The total numbers of species captured per site were 21 at Keshena, 15 above Balsam Row Pond and 20 at Lower Balsam.

- The Keshena site had the greatest number of riverine specialist species with 10 species, followed by Lower Balsam with 8 species and Upper Balsam with 5 species (Table 22). Five riverine specialist species were captured across all three sites; three were only captured in the Keshena site and one only in the Lower Balsam site. The Keshena site had the highest number of species considered intolerant of environmental degradation with 7, followed by 5 at Lower Balsam and 3 at Upper Balsam. No fish were captured that were considered deformed (no DELT occurrences).
- The Keshena site had the highest biomass with 58.2kg (128.4 lbs), followed by Upper Balsam with 46.3 kg (102.2 lbs) and Lower Balsam with 30.5 kg (67.3 lbs). The percent of insectivores by weight was greatest at Upper Balsam with 80 percent, followed by Lower Balsam at 70% and Keshena at 62%.
- The percentage of simple lithophilous spawners by number was greatest for Keshena at 83%, followed by Upper Balsam at 70% and Lower Balsam at 58%. Top carnivores (species that consume fish prey) comprised 8% of the total number of fish captured at Keshena, 13% at Upper Balsam and 24% at Lower Balsam.
- The most common species captured by number were Golden Redhorse (158), followed by Common Shiner (96), Shorthead Redhorse (66), Northern Hog Sucker (64) and Logperch (68). The most common species by weight were Golden Redhorse at 60.9 kg (134.4 lbs), Northern Hog Sucker at 16.7 kg (36.8 lbs), Smallmouth Bass at 12.9 kg (28.5 lbs) and Northern Pike at 8.9 kg (19.6 lbs). Eight species of game fish were captured with Bluegill being the most abundant by numbers and Smallmouth Bass being the most abundant by weight (Table 22). No exotic species were captured.
- Biotic integrity scores were rated as excellent at all three sites with scores of 95 at Keshena, 85 above Balsam Row Pond and 100 below Balsam Row Dam (Table 24).
- Catches (CPE) of riverine species such as Hornyhead Chub, Northern Hog Sucker, Golden Redhorse and Blackside Darter were much lower below Balsam Row Dam compared to above the dam.

Table 22 Fish Species Numbers and Their Weight, By Location, Captured During Non-Wadable Fish Sampling of the Wolf River in 2016.

Species	Keshena		Upper Balsam		Lower Balsam	
	Number Caught	Weight (kg)	Number Caught	Weight (kg)	Number Caught	Weight (kg)
Northern Brook Lamprey	1	0.005	0	0	0	0
Northern Pike	11	5.620	5	1.910	3	1.376
Muskellunge	1	8.010	0	0	0	0
Central Stoneroller	4	1.047	1	0.015	5	0.066
Hornyhead Chub	16	0.151	10	0.072	5	0.032
Common Shiner	65	0.438	31	0.133	0	0
Rosyface Shiner	8	0.020	0	0	0	0
Bluntnose Minnow	1	0.003	7	0.022	4	0.022
Longnose Dace	1	0.002	0	0	0	0
Johnny Darter	2	0.004	0	0	0	0
Banded Darter	4	0.007	0	0	2	0.003
Blackside Darter	16	0.227	4	0.012	3	0.009
Slenderhead Darter	1	0.002	0	0	1	0.002
Logperch	53	0.276	12	0.060	3	0.016
White Sucker	28	2.353	9	2.100	2	1.604
Northern Hog Sucker	40	8.961	16	5.258	8	2.461
Silver Redhorse	0	0	0	0	14	8.749
Golden Redhorse	60	21.604	75	31.099	23	8.233
Shorthead Redhorse	38	3.804	10	0.197	18	1.199
Brook Silverside	0	0	0	0	1	0.001
Rock Bass	0	0	1	0.125	10	0.360
Bluegill	11	0.600	18	0.440	10	0.562
Smallmouth Bass	16	6.085	15	4.795	4	2.050
Largemouth Bass	1	0.004	8	0.108	9	2.604
Black Crappie	0	0	0	0	4	0.980
Walleye	0	0	0	0	1	0.219
Total Fish Captured &Weight	378	59.223	222	46.169	130	30.548
Number of Species Captured	21		15		20	
Nonwadeable IBI Score	95		100		85	
Nonwadeable IBI Rating	Excellent		Excellent		Excellent	

Methods for Tributary Streams – Six wadeable streams were sampled for the purposes of establishing a comprehensive fish community assemblage list above and below the Balsam Row Dam to determine their overall environmental conditions by calculating a fish-based IBI. The Department assigns a stream natural community classification to all stream in the state based on the Wisconsin Stream Model that is built on certain flow and temperature data. It is important to verify the modeled natural community once fish surveys are completed to validate the model and correct for any discrepancies (Lyons 2013). The verified natural community then allows the correct IBI to be applied and calculate an appropriate IBI score for that stream.

Wolf River Tributary Streams Results: Of the six wadable streams monitored, three were located above the Balsam Row Dam and three were located below the dam (Figure 26). The three streams located above the Balsam Row Dam were located within the Menominee Reservation. Chickney Creek was

modeled as a cool-warm headwater stream, however based upon the surveyed species and using the methodology to review and correct the natural community model, this stream more closely represented a cold-water stream. Keshena Creek is an outlet of Legend Lake and was modeled to be a warm mainstem, but after conducting electrofishing surveys the verified natural community was determined to be a cool-warm mainstem. Oshkosh Creek was modeled to be a cool-warm headwater and this modeled natural community fit with the fish species assemblage surveyed. When applying the most appropriate IBI to the three streams above the Dam, all scores placed the streams into the excellent category.

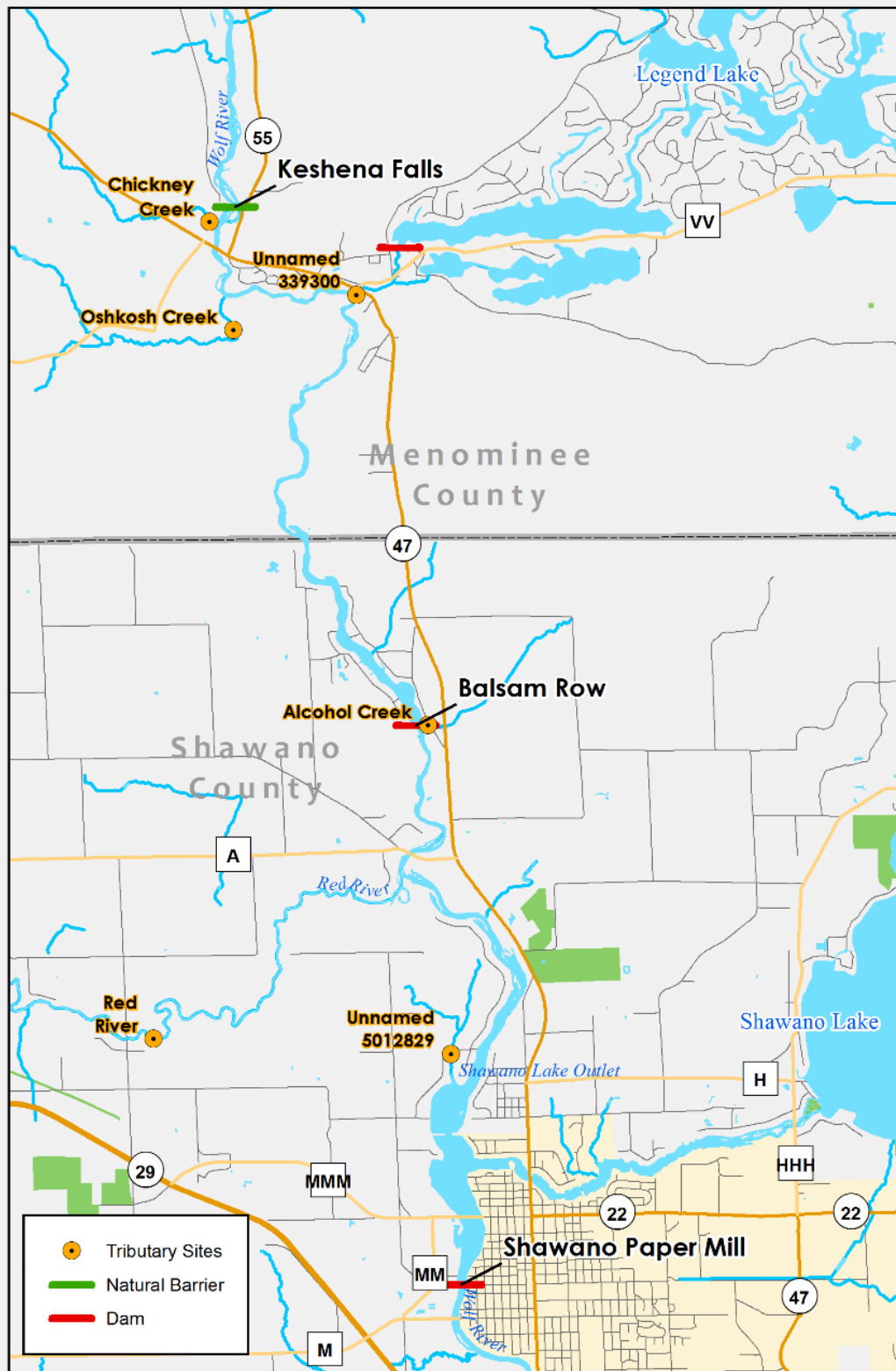


Figure 26 Location of Wadable Tributary Surveys

Chickney Creek (WBIC 341500) is a cold-water tributary to the Wolf River that enters 656 feet below Keshena Falls. Only four species of fish were observed which is typical in a coldwater system that displays low diversity. The dominate catch was Brown Trout followed by Brook Trout. A single specimen of a Central Mudminnow and a Mottled Sculpin completed the species observed. IBI was excellent with a score of 90 using the coldwater IBI.

Oshkosh Creek (WBIC 341100) is a cool-warm headwater tributary to the Wolf River that enters 2133 feet downstream of the STH 47 Bridge. Eight species of fish were surveyed but the catch was dominated by Brook Trout followed by Bluegill. The remaining species were common, tolerant to intermediately tolerant cool-water species typically found in headwater streams. IBI was excellent with a score of 100 using small stream IBI.

Keshena Creek (WBIC 339300) is a cool-warm mainstem tributary to the Wolf River that enters 262 feet downstream of the Fair Grounds Road Bridge. That fish community assemblage contained 17 species which was dominated by Central Stonerollers, White Suckers, Common Shiners, and Johnny Darters. Blackside Darters, Logperch, and Shorthead Redhorse were all surveyed in Keshena Creek and it is likely that these species, that prefer a large stream size, are in direct correlation to the proximity of the survey station and the Wolf River. IBI was excellent with a score of 100 using coolwater stream IBI.

The remaining three streams surveyed enter the Wolf River below the Balsam Row Dam.

- Alcohol Creek was modeled as a cool-warm headwater stream. The natural community verification process when applied to this stream shifted the thermal regime from a cool-warm headwater to a cool-cold headwater. Alcohol Creek (WBIC 339000) is a cool-cold headwater of the Wolf River that enters 262 feet downstream of the Balsam Row Dam. Five species of fish were surveyed, and the dominant species was Central Mudminnow. Interestingly, the second most dominant species were Brook Trout and Blackside Darters. This is not a classified trout stream, so the presence of Brook Trout was not expected. Brook Trout were surveyed between 6.3 and 9.25 inches in length. No young of the year were found in the survey, so it is unclear if natural reproduction is occurring. It is likely these individuals may have found conducive conditions within Alcohol Creek after traveling downstream over the Balsam Row Dam from upstream tributaries. Blackside Darters prefer large, warm water streams and are likely migrants from the Wolf River that find favorable conditions during certain times of the year. Alcohol Creek, based on its location below the dam, may provide habitat that other species of fish require for various life stages, but certain factors such as time of year, flow, and temperature will dictate the extent that fish utilize Alcohol Creek.
- The Red River has a natural community of a large river and this modeled natural community was verified. Red River (WBIC 326600) is a large warm river tributary that enters the Wolf River 984 feet downstream of CTH A. A total of 17 different fish species were surveyed in 2016 (several other species have been found in past surveys). This is the most significant tributary to the Wolf River within the Study Area. The Red River provides diverse and complex habitat that is limited in the isolated reach of the Wolf River between the Balsam Row Dam and the Wolf River Pond.

The diversity within the fish community assemblage and importance of the Red River to the fish community is apparent in the species assemblage and quality of water it provides. Of the 17 species surveyed in the Red River in 2016, six of the species are intolerant to environmental degradation.

- The unnamed tributary to Wolf River Pond (WBIC 5012829) has a modeled natural community as a cold-water stream. Based on the verification process and the species community assemblage, the natural community would most represent a cool-warm headwater. The natural community for this stream is not recommended to be changed based on the tolerance values of the species observed and the local anthropogenic impacts. The unnamed tributary to Wolf River Pond is modeled as a cold-water stream that enters the Wolf River Pond 1640 feet upstream of the boat launch on the western shore of the pond. This stream may likely be more representative of a cool-warm or cool-cold transitional headwater, however the tolerance values associated with the fish community assemblage indicate that human influences are likely impacting the stream and thus its community. The stream lacked intolerant fish species and was dominated by tolerant fish species. Typically, headwater streams are dominated by intolerant species, but the degree to which tolerant species are dominant and intolerant species are absent prevent a new natural community from being proposed. One species present within the community were young of the year Common Carp. Carp is a very tolerant species that is also destructive to habitat. It is likely this tributary is advantageous to Carp for either spawning or nursery habitat and may likely act as a significant source of recruitment of Common Carp to the Wolf River below Balsam Row Dam.

When applying the most appropriate IBI to the three streams below the Dam, the Red River scored excellent, Alcohol Creek scored fair, and the UNT to Wolf River Pond scored poor.

Table 23 Fish Species Captured in Tributary Stream Sites 2016.

Fish Species	Tributary Sampling Site					
	Chickney Cr @ Oshkosh Rd	Oshkosh Cr @ Kittleson Rd	UNT to Wolf River (Keshena Cr)	UNT to Wolf River @ Wolf River Rd	Alcohol Cr @ Balsam Row Rd	Red River @ Maple Ave
Banded Darter						13
Black Bullhead			1			
Blacknose Dace		3				
Blackside Darter			10		12	17
Bluegill		13	3		1	14
Bluegill x Pumpkinseed		3				
Brook Stickleback				79		
Brook Trout	32	60			12	
Brown Trout	64					
Central Mudminnow	1		4	77	23	
Central Stoneroller			27			1
Common Carp				24		
Common Shiner			17			1
Creek Chub		7	4			
Fantail Darter			9			12
Fathead Minnow				3		
Hornyhead Chub			9			
Johnny Darter			27		4	14
Lamprey Ammocoete						9
Largemouth Bass						2
Logperch			3			30
Longnose Dace						4
Mottled Sculpin	1					
Northern Hog Sucker			1			
Northern Pike			2			
Northern Redbelly Dace		3		26		
Pearl Dace		4				
Rock Bass						5
Rosyface Shiner			6			1
Shorthead Redhorse			6			1
Smallmouth Bass						5
White Sucker		4	33			1
Yellow Bullhead			1			
Total # Captured	98	97	163	209	52	130
# species	4	8	17	5	5	16

Table 24 Index of Biotic Integrity Scores for Tributary Stream Sites 2016. Results in bold are for verified natural community classifications.

	Tributary Sampling Site					
	Chickney Cr @ Oshkosh Rd	Oshkosh Cr @ Kittleson Rd	UNT to Wolf River (Keshena Cr)	UNT to Wolf River @ Wolf River Rd	Alcohol Cr @ Balsam Row Rd	Red River @ Maple Ave
Stream Order	1	2	3	2	1	4
Mean Stream Width (ft)	13.1	13.1	9.8	9.8	9.8	49.2
Station Length (ft)	459.3	459.3	344.5	344.5	344.5	1312.3
Modeled Natural Community Classification	Cool/Warm Headwater	Cool/Warm Headwater	Warm Mainstem	Coldwater	Cool/Warm Headwater	Large River
Verified Natural Community Classification	Coldwater	Cool/Warm Headwater	Cool/Warm Mainstem	Coldwater	Cool/Cold Headwater	Large River
Coldwater IBI Rating (IBI Score)	Excellent (90)			Poor (10)		
Coolwater IBI Rating (IBI Score)			Excellent (100)			
Warmwater IBI Rating (IBI Score)			Excellent (74)			Excellent (80)
Headwater IBI Rating (IBI Score)	Fair (40)	Excellent (100)			Fair (40)	

Combined sampling efforts of the Wolf River above and below the Balsam Row Dam and six tributaries produced a large number of fish comprised of a variety of species/families. Fourteen species were sampled and documented by other survey methods or in previous year's surveys. The most numerous species encountered were Bluegill, Bluntnose Minnow, Common Shiner, Golden Shiner, Hornyhead Chub, Rosyface Shiner, Sand Shiner and White Sucker. The most frequently encountered predatory game fish in the tributaries were Brown and Brook Trout, and in the Wolf River were Smallmouth Bass, Largemouth Bass and Northern Pike.

Table 25 Species Collected During Seining By Site and Totals, 2016

	Site Number														Total
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Banded Darter	4	2							2	1					9
Black Crappie										2					2
Blacknose Shiner					2			3							5
Blackside Darter	7			1	2			14	1	1					26
Bluegill			3	2	16	1	41	2		2	6	18	12	14	117
Bluntnose Minnow	2		2	2	27		9	53	5		24	1	25	1	151
Brassy Minnow	2									1					3
Brook Silverside										6				4	10
Central Stoneroller	18		3	1	6			2	6				2		38
Common Shiner	402		8	34	281	47	56	96	4	46		6	111		1091
Creek Chub							1								1
Golden Redhorse	2		8	1	1		20	1			1				34
Golden Shiner							1			1				45	47
Hornyhead Chub	5	1	2	7	70	4	41	27	1	8			26		192
Johnny Darter	2		14		1										17
Largemouth Bass				1	3		4	1	4	17	2	1	3	3	39
Logperch	7	6	5	2				5						5	30
Mimic Shiner											1		1		2
Northern Hogsucker			2												2
Northern Pike					4								3		7
Pumpkinseed												1	1	1	3
Rock Bass					4		1	2	1	14	2		5		29
Rosyface Shiner	9			2		20				56		2			89
Sand Shiner	1		100												101
Shorthead Redhorse			1		2										3
Slenderhead Darter						1									1
Smallmouth Bass							3	1							4
Tadpole Madtom														2	2
Weed Shiner								2			1		3	23	29
White Sucker	1		44		5		4	6	1			5			66
Total	462	9	192	53	424	73	181	215	25	155	37	34	192	98	2150
Number of Species	13	3	12	10	14	5	11	14	9	12	7	7	11	9	30

Appendix N: Game fish and Panfish Assessment

Introduction: The Wolf River Pond and Balsam Row Pond support a diverse fish assemblage that is characteristic of small impoundments on northern Midwestern river systems. Northern Pike, Largemouth Bass, and Smallmouth Bass are the dominant predatory game fish and are sustained entirely through natural reproduction. Naturally reproducing Walleye are present in low density, as are Muskellunge. Bluegill, Black Crappie, and Pumpkinseed compose most of the panfish fishery. Northern Pike, Bluegill, Largemouth Bass, and Black Crappie are found in good numbers in shallow bays where aquatic vegetation is present. Smallmouth Bass are abundant in primarily the riverine habitats between or upstream of the ponds although some are present in the rocky areas of the ponds.

Historical management of this area of the Wolf River has primarily included fishery surveys and implementation of various bag and length limit regulations. Although most of the fish populations in the Wolf River Pond, Balsam Row Pond, Wolf River and connected waters are sustained by natural reproduction, some stocking does occur. In the Wolf River Pond, Muskellunge have been periodically stocked from 1977 to present by both the Department and private sources (Table 26). In Shawano Lake, Walleye have been periodically stocked since the 1940's. More recently, Shawano Lake has been stocked with large fingerling Walleye as part of the Wisconsin Walleye Initiative along with fry stockings from private sources.

Table 26 Muskellunge (Unspecified Strain) Stocking History in Wolf River Pond from 1977 to 2016

Year	Age Class	Number	Mean Length (inches)
2016	Large Fingerling	300	13.0
2014	Yearling	250	10.0
1991	Fingerling	600	10.9
1987	Fingerling	1,800	9.0
1985	Fingerling	400	12.0
1984	Yearling	100	5.0
1983	Fingerling	131	11.0
1982	Fingerling	150	11.0
1979	Fingerling	300	8.0
1978	Fingerling	300	8.0
1977	Fingerling	305	9.0

Methods: Various methods were used to gather sport fish population data (Table 27). Fish sampling methods in Wolf River Pond and Balsam Row Pond followed protocols for statewide lakes assessment

(Simonson et al. 2008). These sampling methods included spring fyke netting (SNI and SNII) to target adult Walleye, Northern Pike, and Muskellunge, early spring electrofishing (SEII) to target Largemouth Bass, Bluegill, and other centrarchids, and when applicable an early summer fyke netting (SNIII) to target panfish (primarily Bluegill and Pumpkinseed). In addition, spring and summer electrofishing surveys were conducted in the riverine sections from Wolf River Pond upstream to Balsam Row Dam and from Balsam Row Pond upstream to Keshena Falls to target spring spawning migrations as well as residential summer game fish populations.

Table 27 Surveys by protocol type conducted in Wolf River Pond and Balsam Row Pond

Waterbody	Survey Type	Protocol	Year Completed
Wolf River Pond	Spring Fyke Netting	SNI, SNII	1990, 2014
Wolf River Pond	Spring Electrofishing	SEII	1983, 1991, 2014
Wolf River Pond	Summer Mini Fyke Netting	SNIII	2005
Wolf River Pond	Fall Electrofishing	EF	1991, 2005
Wolf R. above Wolf R. Pond	Non-Wadeable	IBI	2016
Wolf R. above Wolf R. Pond	Spring Electrofishing	SEII	2014
Wolf R. above Wolf R. Pond	Fall Electrofishing	EF	2014
Balsam Row Pond	Spring Fyke Netting	SNI, SNII	1990, 2016
Balsam Row Pond	Spring Electrofishing	SEII	2016
Balsam Row Pond	Spring Electrofishing - Centrarchids	SEII	2011
Balsam Row Pond	Spring Fyke Netting - Centrarchids	SNII	2011
Balsam Row Pond	Fall Electrofishing	EF	1990, 1999
Balsam Row Pond	Summer Electrofishing	Non-protocol	1977
Above Balsam Row Pond	Fall Electrofishing	EF	2016
Above Balsam Row Pond	Spring Electrofishing	Non-protocol	2016

Spring Fyke Netting (SNI) Wolf River Pond – Fyke nets were set at ice-out from April 25 to May 6, 2014 and checked daily. These nets targeted Walleye, Northern Pike, and Muskellunge although other species were captured as bycatch. Fyke nets had black 1.5-inch stretch mesh, 3x6 foot frames, and 3-ft diameter hoops. Nets were 28-ft long plus lead length (mostly 50-ft leads with a few slightly shorter). Fyke nets were set in 9 different locations around the pond (Figure 27). Total effort equaled 115 net nights.

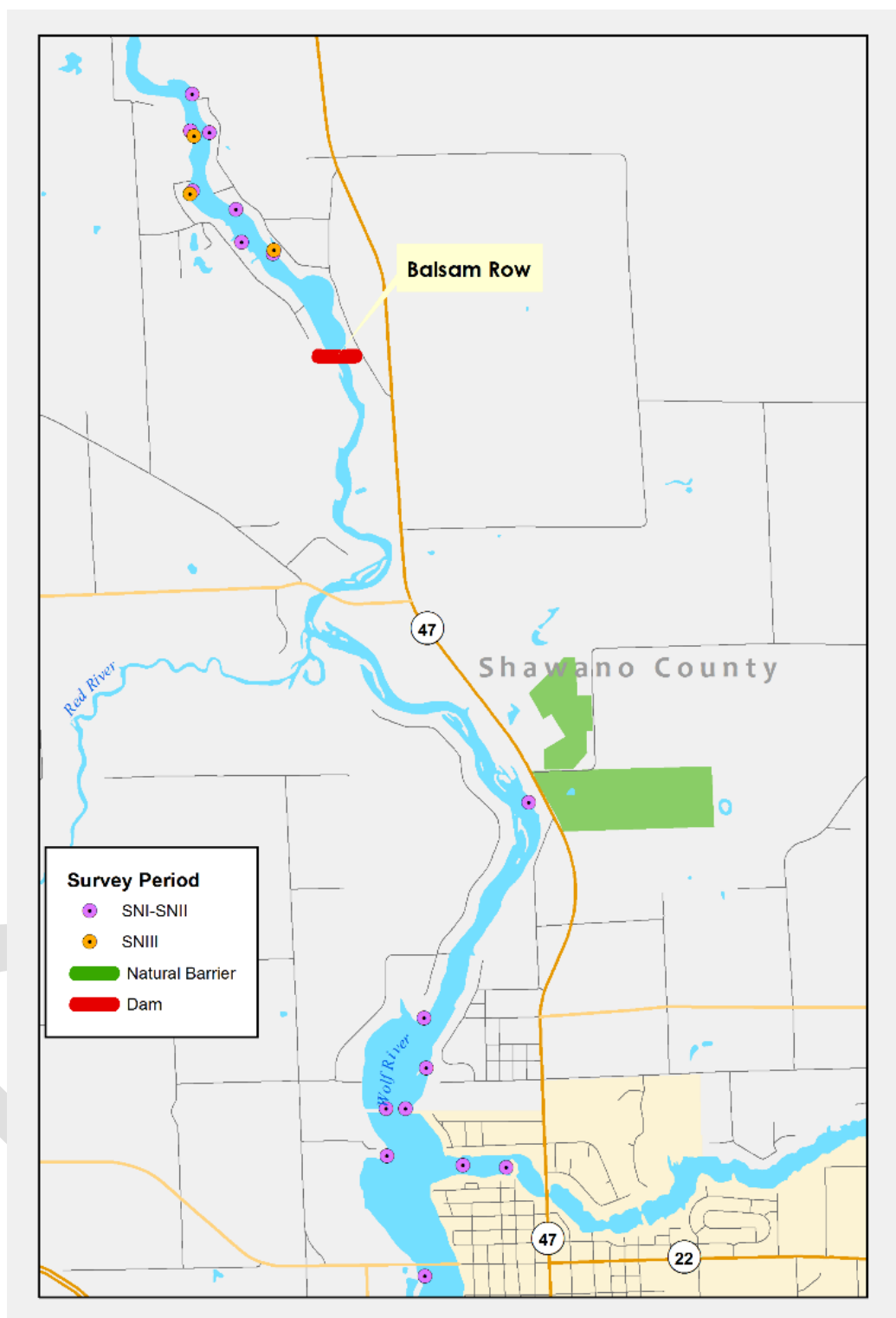


Figure 27 Location of Fyke Nets Used During Spring and Summer Netting Periods of Wolf River Pond in 2014 and Balsam Row Pond in 2016

Data collected from daily adult game fish catch included sex and reproductive condition (when applicable), total length (nearest millimeter), weight (nearest gram or kilogram), and preexisting marks. Lengths and weights were collected from a sub-sample of panfish and non-game fish and the rest were counted. All newly captured Northern Pike, Walleye, and Largemouth Bass were marked with a temporary upper caudal fin clip for the purpose of calculating a mark and recapture population estimate. Muskellunge were tagged with passive integrated transponder (PIT) tags. Scales (Muskellunge), dorsal spines (Walleye), and otoliths (Largemouth Bass, Bluegill, and Black Crappie) were collected from stratified samples (5 per one-inch size group) for age estimation.

Electrofishing (SEII) Wolf River Pond - A night-time electrofishing survey was conducted on May 21, 2014 to target Largemouth Bass, Bluegill, and other panfish. A standard Department electrofishing boat was used; set at 200 volts and 13 amps (peak) pulsed DC, with a 25% duty cycle and 50 pulses per second. Two people netted fish; thus, catch per unit effort (CPUE) data are catch/hour or mile. The entire shoreline was shocked for game fish and three randomly selected 0.5-mile segments were shocked for all fish (Figure 28). Data collected from game fish and panfish followed the same protocol as spring netting.

Wolf River above Wolf River Pond upstream to Balsam Row Dam: Daytime electrofishing surveys were conducted on May 7 and September 4, 2014 within the Wolf River above Wolf River Pond (Figure 30). Electrofishing effort targeted the Wolf River downstream of Balsam Row Dam including the scour pool downstream of the powerhouse and 1.0 mile of river channel (right bank only). Data collected from game fish followed the same protocol as spring netting and electrofishing.

Spring Fyke Netting (SNI) Balsam Row Pond – Fyke nets were set at ice-out from March 27 to April 16, 2016 and lifted every other day. These nets targeted Walleye, Northern Pike, and Muskellunge although other species were captured as bycatch. Fyke nets had black 1.5-inch stretch mesh, 3x6 foot frames, and 3-ft diameter hoops. Nets were 28 ft long plus lead length (mostly 50-ft leads with a few slightly shorter). Fyke nets were set in 8 different locations around the basin (Figure 27). Total effort equaled 98 net nights.



Figure 28. Locations of Electrofishing Runs on Wolf River and Balsam Row Ponds and Wolf River, 2014 and 2016.

Data collected from daily adult game fish catch included sex and reproductive condition (when applicable), total length (nearest millimeter), weight (nearest gram or kilogram), and preexisting marks. Lengths and weights were collected from a sub-sample of non-game fish and the rest were counted. All newly captured Northern Pike, Walleye, and Largemouth Bass were marked with a temporary upper caudal fin clip. Muskellunge were tagged with passive integrated transponder (PIT) tags. Age structures were collected for age estimation.

Electrofishing (SEII) Balsam Row Pond - A nighttime electrofishing survey was conducted on May 26, 2016 to target Largemouth Bass, Bluegill, and other panfish. A standard Department electrofishing boat was used; set at 200 volts and 13 amps (peak) pulsed DC, with a 25% duty cycle and 50 pulses per second. Two people netted fish; thus, CPUE data are catch/two netter hour or mile. The entire shoreline was shocked for all fish (Figure 28). Data collected from game fish followed the same protocol as spring netting.

Wolf River above Balsam Row Pond upstream to Keshena Falls: A daytime electrofishing survey was conducted on April 14, 2016 within the Wolf River above Balsam Row Pond (Figure 30) to target potential game fish migrants from the Balsam Row Pond and/or river residential game fish. Electrofishing was conducted with two boomshockers with one boat on each bank shocking in a downstream direction. Data collected from game fish followed the same protocol as spring netting and electrofishing. Fish other than game and non-game fish species were also collected from the first 1.5 miles of river. Summer electrofishing surveys in this area were also conducted by other Department staff to collect fish community and IBI information (see Appendix M).

Data Analysis - Total catch and catch per unit effort (CPUE) was calculated by gear type for all species. Length frequency distributions were generated by gear type for game fish species with 25 or more individuals collected. Length range, mean length, and modal lengths were calculated for all species.

Population abundance of adult Northern Pike was estimated by mark-recapture methods from ice-out to early May. Muskellunge, Walleye and Largemouth Bass estimates were not computed due to difficulty obtaining a large enough mark and recapture sample. Population Estimates were calculated by the Schnabel formula (Ricker 1975).

Proportional stock density (PSD) and relative stock density (RSD) were calculated for the dominant game fish species according to quality and stock sizes defined by Anderson and Gutreuter (1983) and by Wisconsin DNR Species Teams. The PSD and RSD value for a species is a number of fish of a specified length and longer divided by the number of fish of stock length or longer, the result multiplied by 100 to give a percentage. PSD and RSD values were compared to lakes across the state by percentiles.

Aging structures were used to estimate mean length at age and age frequency distributions for Bluegill, and Black Crappie. In addition, mean age at length was determined for quality size fish and compared to statewide data. Survival rates were calculated from the descending limb of catch curves (Ricker 1975).

Fish condition was assessed by analysis of relative weight (W_r) (Wege and Anderson 1978). Relative weight is a tool that biologists use to look at body condition of fish by comparing the length of the fish to

an expected weight for that length. Standard weight equations for various game fish species have been developed to make this comparison (Anderson and Neuman 1996). Relative weights for each fish were calculated by dividing a fish's actual weight by the standard weight for a fish of that length and multiplying by 100. Relative weight values between 75 and 100 indicate normal weight for a given length. A relative weight value greater than 100 indicates that a fish is in excellent condition. A relative weight value less than 75 indicates a fish is in poor condition. Differences in condition (W_r) were analyzed among different length-classes.

Wolf River Pond Results - Sampling of the Wolf River Pond produced a wide variety of fish species. A total of 5,332 fish of 23 species representing 7 families were collected during our 2014 surveys (Table 28). Most species encountered were known to occur in the Wolf River system. The most frequently encountered and common species were Black Crappie, Bluegill, Northern Pike, Yellow Bullhead, Golden Redhorse, Pumpkinseed, Shorthead Redhorse, and Rock Bass. These species made up 92.6% of the total catch (electrofishing and netting combined). A non-native species, the Common Carp, was found at moderate levels of abundance (CPUE = 4.1 per mile) in Wolf River Pond; 75th statewide percentile rank). A state listed special concern species, Lake Chubsucker (total catch = 30), was found primarily in the Wolf River Pond. Bullhead species were represented by primarily Yellow and Brown Bullheads with a low number of Black Bullhead. Percid species captured included Yellow Perch, Walleye, and Blackside Darter. Sucker species were sampled in high numbers and included Golden Redhorse, Shorthead Redhorse, Silver Redhorse, Northern Hog Sucker, Lake Chubsucker, and White Sucker. Hornyhead Chubs and Common Shiners, both historically common minnow species in this watershed, were sampled in very low numbers (the former only in riverine habitat above the pond). One Lake Sturgeon was observed about 1.0 mile downstream of the Balsam Row Dam while motoring up river on May 7, 2014.

Table 28 Catch Metrics for Fish Sampled on Wolf River Pond (WRP) in 2014 and Balsam Row Pond (BRP) in 2016

Species	Number of Fish Caught (with CPUE in parentheses)						
	SNI + SNII		SNIII	SEII		Total	
	WRP	BRP	BRP	WRP	BRP	WRP	BRP
Bowfin	18 (0.32)	0 (0)	0 (0)	1 (0.7)	0 (0)	19	0
Northern Pike	483 (8.63)	122 (1.24)	13 (1.44)	4 (3.7)	5 (1.6)	487	140
Muskellunge	7 (0.13)	0 (0)	0 (0)	0 (0)	0 (0)	7	0
Common Carp	32 (0.57)	0 (0)	0 (0)	20 (4.1)	0 (0)	52	0
Golden Shiner	3 (0.05)	0 (0)	0 (0)	13 (8.7)	0 (0)	16	0
Common Shiner	0 (0)	0 (0)	0 (0)	2 (1.3)	6 (2.0)	2	6
White Sucker	43 (0.77)	8 (0.08)	2 (0.22)	2 (1.3)	12 (3.9)	45	22
Northern Hog Sucker	6 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	6	0
Lake Chubsucker	28 (0.50)	0 (0)	0 (0)	2 (1.3)	0 (0)	30	0
Silver Redhorse	5 (0.09)	0 (0)	0 (0)	10 (6.7)	0 (0)	15	0
Golden Redhorse	162 (2.89)	345 (3.52)	17 (1.89)	33 (22.0)	122 (39.9)	195	484

Shorthead Redhorse	108 (1.93)	24 (0.24)	0 (0)	2 (1.3)	0 (0)	110	24
Black Bullhead	7 (0.13)	3 (0.03)	1 (0.11)	0 (0)	3 (1.0)	7	7
Yellow Bullhead	363 (6.48)	2 (0.02)	1 (0.11)	16 (10.7)	0 (0)	379	3
Brown Bullhead	18 (0.32)	0 (0)	0 (0)	7 (4.7)	0 (0)	25	0
Rock Bass	93 (1.66)	3 (0.03)	7 (0.78)	9 (6.0)	15 (4.9)	102	25
Pumpkinseed	139 (2.48)	3 (0.03)	14 (1.56)	50 (33.3)	2 (0.7)	189	19
Bluegill	1252 (22.36)	104 (1.06)	275 (30.56)	182 (121.3)	7 (2.3)	1434	386
Smallmouth Bass	3 (0.05)	3 (0.03)	3 (0.33)	15 (3.1)	6 (2.0)	18	12
Largemouth Bass	57 (1.02)	2 (0.02)	0 (0)	28 (5.7)	0 (0)	85	2
Black Crappie	2015 (35.98)	16 (0.16)	28 (3.11)	26 (17.3)	3 (1.0)	2041	47
Yellow Perch	38 (0.68)	1 (0.01)	2 (0.22)	26 (17.3)	0 (0)	64	3
Walleye	3 (0.05)	1 (0.01)	0 (0)	1 (0.2)	0 (0)	4	1

Game fish – Northern Pike, Largemouth Bass, and Smallmouth Bass dominated the predator game fish assemblage. A small number of Muskellunge and Walleye were also sampled.

- Northern Pike - A total of 483 (8.6 fish/net night) Northern Pike were sampled in fyke nets. Electrofishing yielded 3.7 Northern Pike per mile. Estimated population size for Northern Pike >10.0 inches were 1102 (5.2 pike/acre), with 95% confidence intervals of 857 to 1541. Females comprised 43% of total catch with lengths ranging from 11.5 – 33.7 inches. Average length and weight for females was 20.1 inches and 2.6 pounds (Figure 29). Males comprised 46% of the total catch and length ranged from 10.6 – 28.7 inches. Average length and weight for males was 17.3 inches and 1.3 pounds (Figure 29). Size structure for all pike was moderate to low, as the overall PSD₂₁ value was 20% and the RSD₂₆ was 4% . Relative weight was at moderate to low levels with values averaging 88 across all size classes (range 53 to 136). Overall, Northern Pike population abundance and size structure in the Wolf River Pond would be considered of moderate quality when compared to statewide indices.

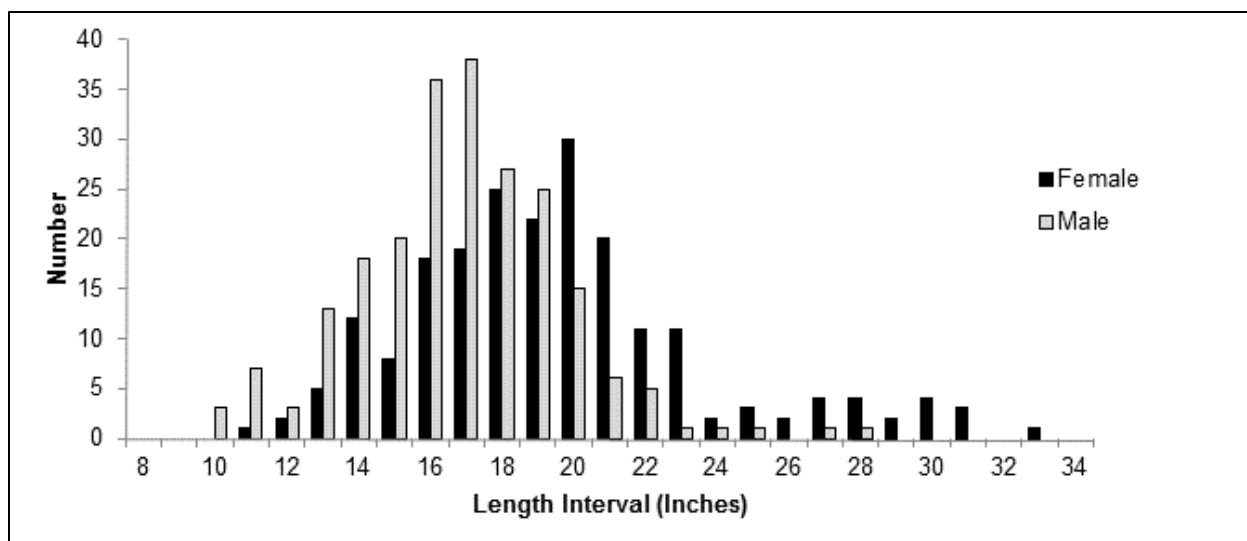


Figure 29 Northern Pike Length Frequency Distribution from Spring Netting in Wolf River Pond, May 2014

- Walleye - Only 7 Walleye (4 in the Wolf River Pond) were captured during our survey and we were unable to calculate a population estimate. Walleye size range was 8.1 to 18.5 inches. It is likely Walleye density is at very low levels since Walleyes have historically maintained a low population number in the Wolf River Pond. We also sampled very few Walleye (3) in the Wolf River below Balsam Row Dam during optimal spawning times.
- Largemouth Bass – A total of 57 (1.0 bass/net night) Largemouth Bass were captured in fyke nets (Figure 30) and 28 (5.7 bass/mile) by electrofishing (Figure 31). A population estimate could not be computed for Largemouth Bass due to poor mark/recapture sample. The electrofishing catch rate ranked at the 19th percentile statewide which could be considered low for relative abundance (Table 31). Largemouth Bass average length was 14.0 inches (range 7.1 to 18.8 inches); with electrofishing modal lengths of 10.0 and 14.0 inches. Average weight was 1.8 pounds with a range of 0.8 – 4.2 pounds. Size structure was above average, with an overall PSD₁₂ value of 81% which ranked at the 82nd percentile when compared to statewide data (Table 30). Legal size (RSD₁₄) and trophy size (RSD₁₈) bass comprised 63% and 4% of the stock size bass sampled, respectively. Relative weight was average with a mean W_r value of 99, ranging from 73 to 117.

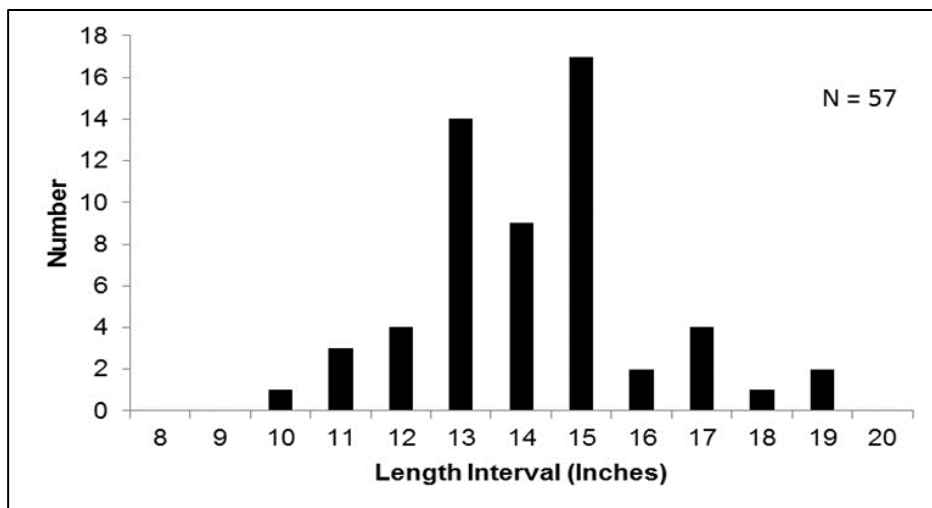


Figure 30 Largemouth Bass Length Frequency Distribution Taken from Netting in Wolf River Pond, May 2014.

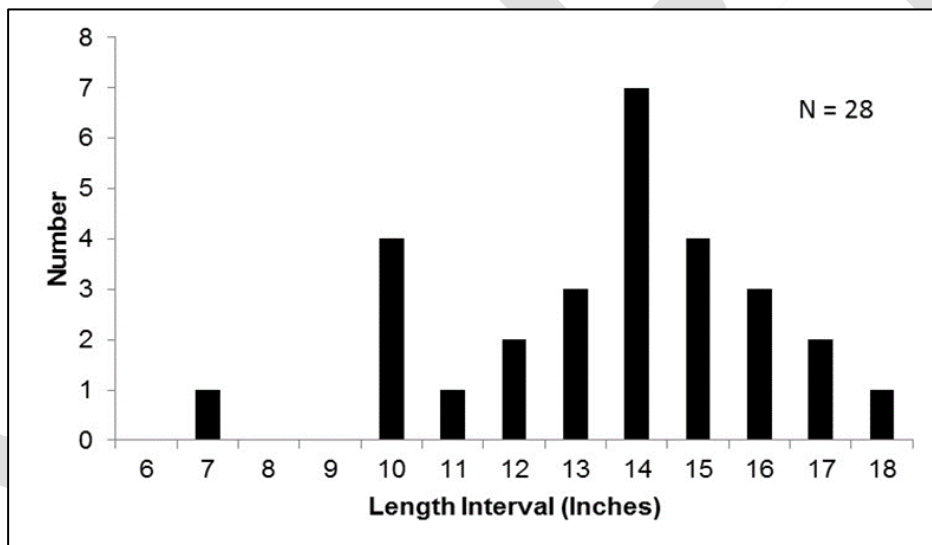


Figure 31 Largemouth Bass Length Frequency Distribution Taken from Electrofishing Catch, Wolf River Pond, May 2014

- Bluegill - A total of 1252 (22.4/net night) Bluegill were captured in fyke nets and 182 by electrofishing (121.3/mile). The electrofishing catch rate ranked at the 56th percentile statewide which could be considered moderate for relative abundance (Table 31). Bluegill average length from fyke net catch was 5.7 inches (5.5-8.4 inches); with a modal length of 6.5 inches (Figure 32). Bluegill average length from boomshocking catch was 5.3 inches (range 3.0-8.2 inches), with modal lengths of 5.0 and 6.0 inches (Figure 33). Pooled fyke net and electrofishing catch data showed an overall PSD₆ value of 53% and RSD₇ 11%. Exceptional sized (RSD₈) Bluegill comprised 4% of the catch. Bluegill electrofishing size structure metrics ranked at the 72nd percentile statewide and has not changed significantly from past surveys (Table 29). Growth rates were moderate when compared to statewide metrics. Bluegill reached

harvestable size (>6.0 inches) after 4 summers of growth (Table 29). Relative weight was at moderate levels with an average value of 94, ranging from 77 to 106. Bluegill age composition was comprised of fish from ages 1 to 9 with most Bluegill fully recruited to the adult population at age 3. Total annual mortality for ages 3-9 was estimated to be 46%.

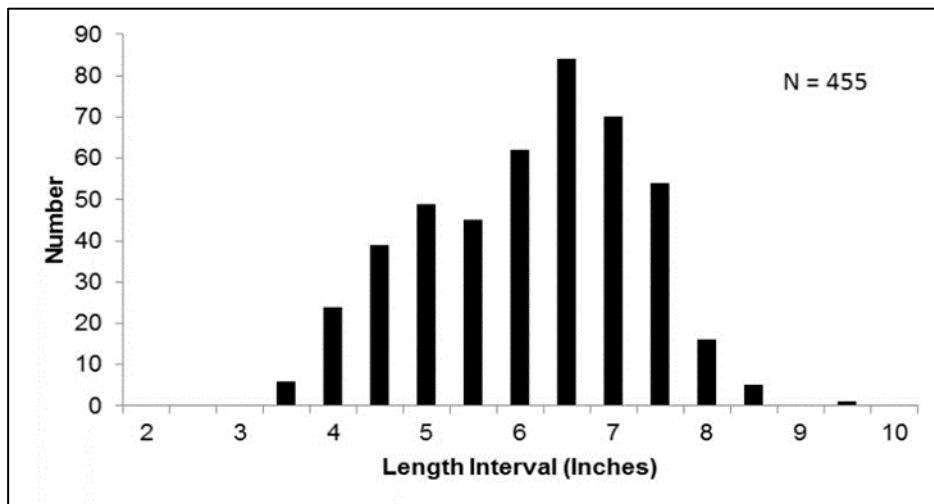


Figure 32 Bluegill Length Frequency Distribution Taken from Fyke Netting, Wolf River Pond, April/May 2014. Only a subsample of the 1,252 fish captured were measured.

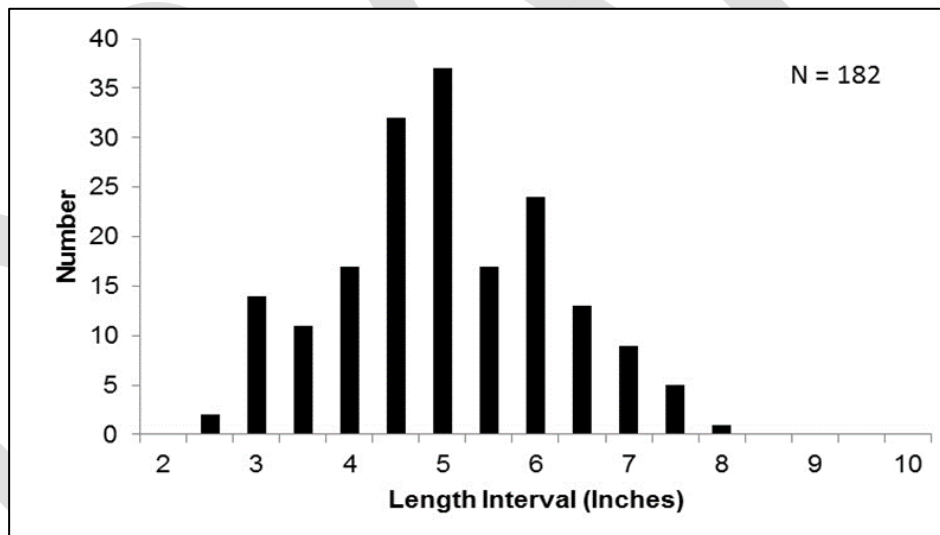


Figure 33 Bluegill Length Frequency Distribution Taken from Electrofishing, Wolf River pond, April/May 2014

- Black Crappie - A total of 2015 (36.0 fish/net night) Black Crappie were captured in fyke nets and 26 by electrofishing (17.3/mile). The electrofishing catch rate ranked at the 74th percentile statewide which could be considered moderate-high for relative abundance (Table 31). Black Crappie average length was 6.0 inches (range 3.9-14.5 inches); with a mode of 6.5 inches (Figure 34). Size structure was at moderate levels with a fyke net PSD₈ value of 32% and RSD₁₀ of 13%. Growth rates were moderate when compared to statewide metrics. Black Crappie reached

harvestable size (8.0 inches) after 4 summers of growth (Table 29). Relative weight was acceptable with an average value of 96, ranging from 78-114. Black Crappie age composition was comprised of fish from ages 2 to 16. Total annual mortality for ages 4-16 was 31%.

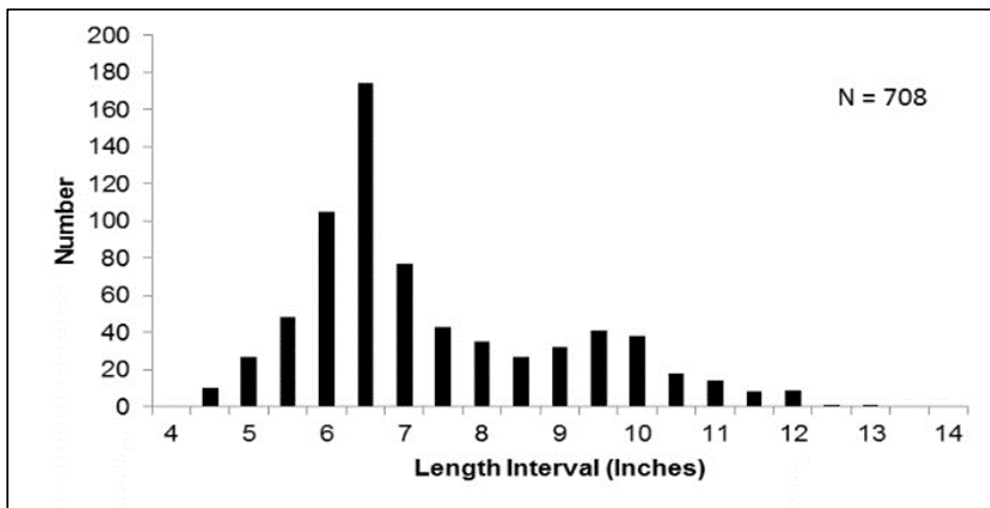


Figure 34 Black Crappie Length Frequency Distribution taken from Fyke Netting, Wolf River Pond, April 2014. Only a subsample of the 2,015 fish captured were measured

- Pumpkinseed** - Pumpkinseed comprised only 3.5% of total catch and abundance was considered below average. A total of 139 (2.5/net night) Pumpkinseed were captured in fyke nets. Electrofishing CPE was 33.3 fish per mile. Average length for Pumpkinseed was 5.4 inches (range 3.2 – 9.9 inches) (Figure 35). Size structure was moderate, with an overall PSD₆ value of 45% and RSD₇ of 7%.

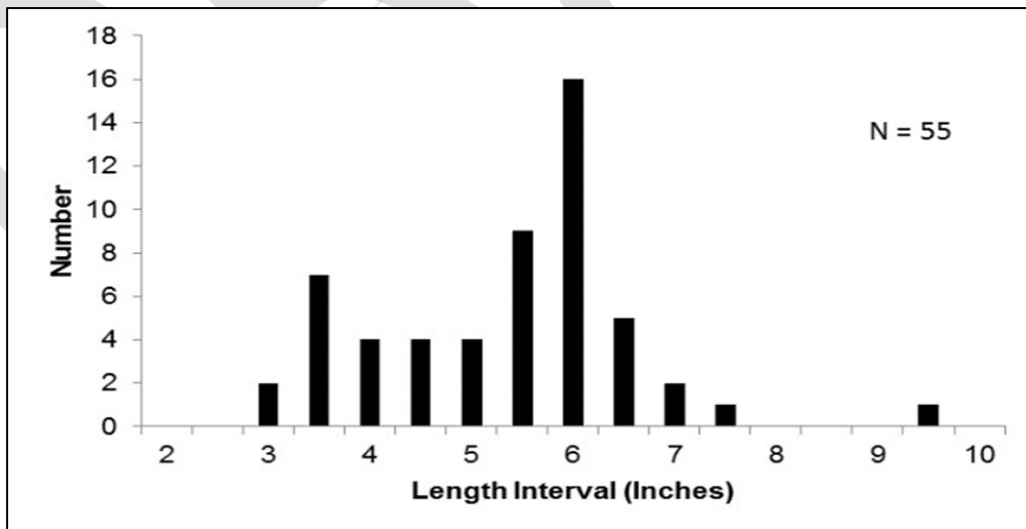


Figure 35. Pumpkinseed Length Frequency Distribution taken from Fyke Netting, Wolf River Pond, April 2014

Table 29 Growth metrics for various predatory game fish and panfish in Wolf River Pond (WRP), 2014 and Balsam Row Pond (BRP), 2016.

Waterbody	Species	Total (N)	Length Bin (inches)	Mean Age and Range (years)	Percentile Rank	Growth Rating
WRP	Largemouth Bass	5	14.0 - 14.9	9.0 (6-12)	27th	Slow
WRP	Bluegill	6	6.0-6.5	4.3 (4-5)	59th	Moderate
WRP	Bluegill	12	7.0-7.5	5.8 (4-7)	53rd	Moderate
WRP	Black Crappie	8	8.0-8.5	4.5 (4-6)	50th	Moderate
WRP	Black Crappie	13	10.0-10.5	6.2 (5-8)	16th	Slow
BRP	Bluegill	16	6.0-6.5	4.1 (4-5)	64th	Moderate
BRP	Bluegill	11	7.0-7.5	5.3 (5-6)	72nd	Fast
BRP	Black Crappie	2	8.0-8.5	5.0	-	Slow
BRP	Black Crappie	1	10-10.5	12.0	-	Slow

Balsam Row Pond Results - In the Balsam Row Pond, a total of 1,181 fish in 21 fish species, representing 7 families were collected during our surveys (Table 28). Most species encountered were known to occur in the Wolf River system. The most frequently encountered and common species were Bluegill, Northern Pike, and Golden Redhorse. These species made up 77.7% of the total catch (electrofishing and netting combined). Panfish species were dominated by primarily Bluegill with lesser numbers of Black Crappie, Pumpkinseed, Rock Bass. Predatory game fish species were dominated by Largemouth Bass and Smallmouth Bass. Bullhead species were represented by Yellow, Black and Brown Bullheads. Yellow Perch and Walleye were present in low numbers. Sucker species were sampled in high number and comprised of Golden Redhorse, Shorthead Redhorse and White Sucker.

- Northern Pike – In total, 140 Northern Pike were collected: the catch rates were 1.2 fish per net night during fyke netting and 1.6 per mile of shoreline during SEII electrofishing. The SEII catch rate ranked in the 48th percentile statewide (Table 31). Estimated population size for Northern Pike >10.0 inches were 332 (4.2 pike/acre), with 95% confidence intervals of 220 to 678. Females comprised 43% of total catch. Female length averaged 22.4 inches and ranged from 12.4 -36.8 inches; with a modal length of 20.0 inches (Figure 36). Males comprised 45% of the total catch. Length averaged 17.6 inches and ranged from 10.2 – 28.8 inches; with a modal length of 20.0 inches. Size structure for all pike was moderate with a PSD₂₁ and RSD₂₆ value of 26% and 11%, respectively. Relative weight was at moderate to low levels with values averaging 87 across all size classes (range 76 to 96). Overall, Northern Pike population abundance and size structure in the Balsam Row Pond would be considered of moderate quality when compared to statewide indices.

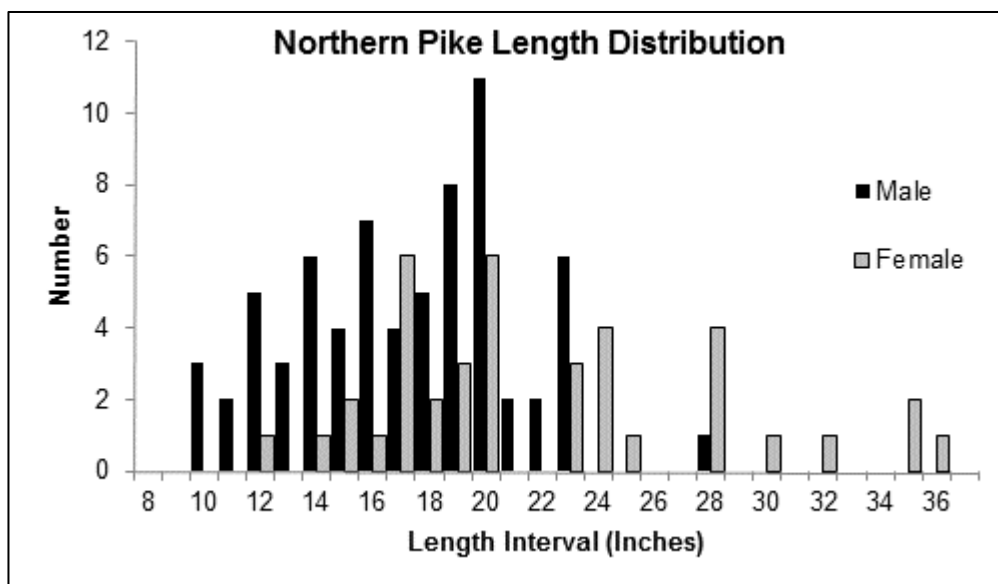


Figure 36 Northern Pike Length Frequency Distribution for Sexed Northern Pike in Balsam Row Pond (Spring Netting 2016).

- Bluegill – In total, 386 Bluegills were collected; the catch rates were 1.1 and 30.6 per net night during SNI- SNII and SNIII fyke netting, respectively. The SEII electrofishing catch rate was 2.3 per mile of shoreline which ranked at the 2nd percentile statewide (Table 31). The relatively low SEII catch rate suggests Bluegill are not very abundant, but in terms of the total number of fish caught during spring netting and electrofishing, Bluegill were the most abundant species. Bluegill size structure was at high quality levels. Bluegill average length was 7.3 inches (range 3.6-8.8 inches); with a modal length of 6.5 inches (Figure 37). Fyke net and electrofishing catch pooled length data showed an overall PSD₆ value of 78% and RSD₇ of 39%. Exceptional sized (RSD₈) Bluegill comprised 6% of the catch. Bluegill size structure metrics ranked at the 95th percentile statewide. Growth rates were moderate to fast when compared to statewide metrics. Bluegill reached harvestable size (>6.0 inches) after 4 summers of growth (Table 29). Relative weight was at moderate levels with an average value of 103, ranging from 82 to 129. Relative weight values were consistent among all sizes. Bluegill age composition was comprised of fish from ages 1 to 9 with most Bluegill fully recruited to the adult population at age 3.

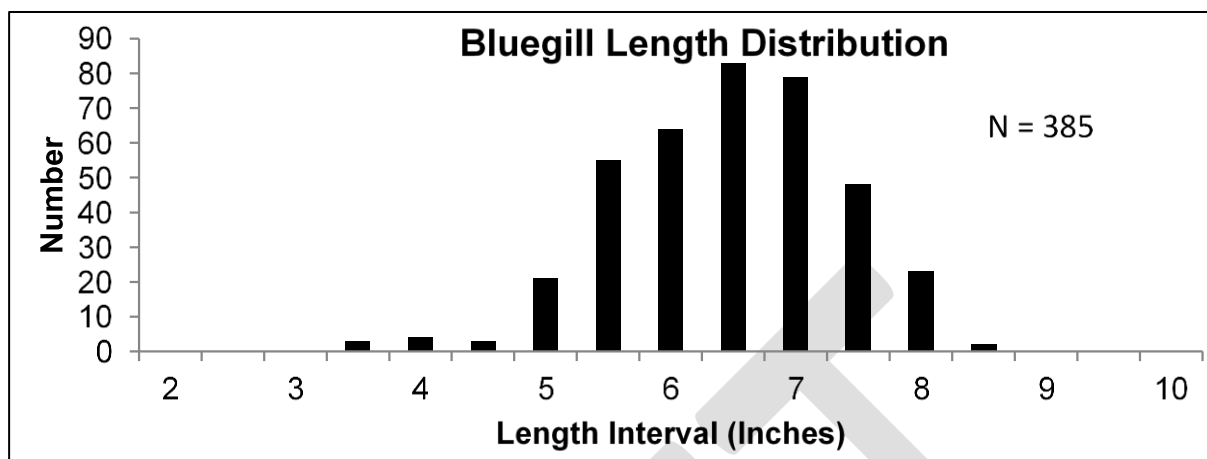


Figure 37 Bluegill Length Frequency Distribution taken from Fkye Netting, Balsam Row Pond, May 2016.

- **Black Crappie** - In total, 47 Black Crappie were collected; the catch rates were 0.2 and 3.1 per net night during SNI- SNII and SNIII fyke netting, respectively. The SEII electrofishing catch rate was 1.0 fish per mile of shoreline. The electrofishing catch rate ranked at the 8th percentile statewide which could be considered very low for relative abundance. Black Crappie average length was 8.8 inches (range 7.8-12.3 inches); with a mode of 9.0 inches (Figure 38). Size structure was at moderate to high levels with a fyke net PSD₈ value of 78% and RSD₁₀ of 50%. Relative weight was acceptable with an average value of 104, ranging from 97-115. Growth and mortality metrics were not estimated due to poor age structure sample size.

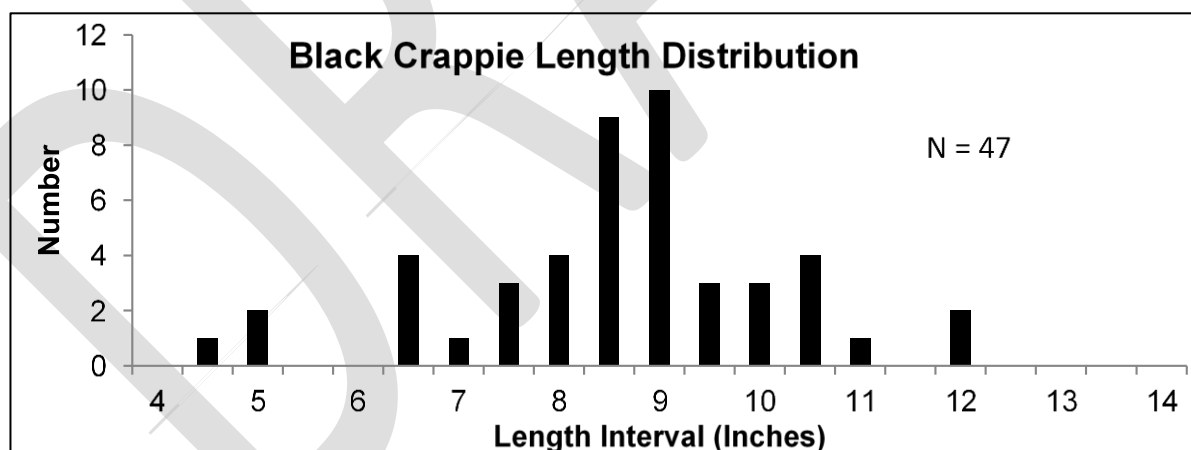


Figure 38 Black Crappie Length Frequency Distribution taken from Fkye Netting, Balsam Row Pond, May 2016.

- **Other Predatory Game Fish and Panfish** – Smallmouth Bass, Muskellunge, and Walleye were also sampled but in very low numbers. Smallmouth Bass were found in moderate to high density during the riverine electrofishing survey and will be described in more detail in that section. We suspect Muskellunge and Walleye are at very low density. Other panfish sampled included Pumpkinseed, Yellow Perch and Rock Bass in low numbers (19, 3, and 25, respectively).

Table 30 Game fish and panfish size structure metrics from SEII electrofishing surveys, Wolf River Pond 2014, and Balsam Row Pond 2016. Stock and quality sizes determined by statewide species teams.

	Average Length (Range)		Stock Quality Size	No. of Stock Quality		PSD Percentile Rank		Size Rating	
Species	WRP	BRP	State	WRP	BRP	WRP	BRP	WRP	BRP
Bluegill	5.3 (3.0-8.2)	7.2 (5.9-8.0)	3.0 6.0	180 52	0	29% 44 th	NA	Mod	NA
Largemouth Bass	14.0 (7.1-18.8)	0	8.0 12.0	27 22	0	81% 82 nd	NA	Mod- High	NA
Pumpkinseed	5.7 (3.5-7.6)	0	3.0 6.0	49 25	0	50% 59 th	NA	Mod- High	NA
Northern Pike	19.7 (10.1- 31.2)	18.6 (12.4- 30.6)	14.0 21.0	16 6	0	38% 47 th	NA	Mod	NA
Black Crappie	7.6 (2.7-11.6)	8.9 (8.5-9.2)	5.0 8.0	25 8	0	32% 35 th	NA	Mod- Low	NA
Smallmouth Bass	9.9 (7.7-14.0)	13.8 (10.2- 18.6)	7.0 11.0	15 4	0	27% -	NA	Mod- High	NA
Yellow Perch	5.9 (3.7-10.0)	0	5.0 8.0	17 2	0	12% 68 th	NA	Mod	NA
Rock Bass	0	5.4 (2.3-8.7)	NA	NA	NA	NA	NA	NA	NA

Table 31 Catch metrics for Wolf River Pond (2014) and Balsam Row Pond (2016) based on SEII surveys and Relative State Rankings.

	CPUE (No./mile)		Percentile Rank		Overall Abundance Rating		Length Index (in)	Length Index CPUE (No./mile)	
Species	WRP	BRP	WRP	BRP	WRP	BRP	Statewide Index	WRP	BRP
Bluegill	121.3	2.3	56 th	2 nd	Mod	Low	≥ 7.0	10.0	0
Largemouth Bass	2.7	0	19 th	-	Low	Low	≥ 14.0	3.5	0
Pumpkinseed	33.3	0.7	83 rd	2 nd	Mod- High	Low	≥ 7.0	2.7	0
Northern Pike	2.7	1.6	78 th	48 th	Mod	Mod	≥ 26.0	0.4	0
Black Crappie	17.3	1.0	74 th	-	Mod	Low	≥ 10.0	3.3	0
Smallmouth Bass	8.0	2.0	-	-	Low	Low	≥ 12.0	0.4	0
Yellow Perch	17.3	0	66 th	-	Low	Low	≥ 8.0	1.3	0

Wolf River above Wolf River Pond to Balsam Row Dam Results - A total of 263 fish in 16 species, representing 6 families were collected in the 1.0-mile reach of river downstream of Balsam Row Dam during electrofishing surveys on May 7 and September 4, 2014 (Table 32). Golden Redhorse, Smallmouth Bass, Shorthead Redhorse, Northern Hog Sucker, and Silver Redhorse made up 90.5% of the total catch. Redhorse and other sucker species dominated the catch on both sampling days. Game fish were sampled in higher numbers in September. During the September survey, a total of 33 Smallmouth Bass were captured with a catch rate of 33 bass per mile which ranks at the 97th percentile statewide for non-wadable river catch. Smallmouth Bass average length was 8.2 inches (range 2.5-16.6 inches); with a mode of 7.2 inches (Figure 39). Size structure was at moderate levels with an PSD₁₁ and RSD₁₄ at 29% and 4%, respectively. One Muskellunge was observed in the pool area just downstream of the dam/powerhouse during the May survey. In addition to game fish, one Common Carp was sampled during the September survey.

On August 26, 2016, an IBI survey was completed in the same 1.0-mile reach below Balsam Row Dam. A total of 15 Smallmouth Bass were captured with a catch rate of 15.0 bass per mile. A low number of Northern Pike, Largemouth Bass, and Rock Bass were also captured.

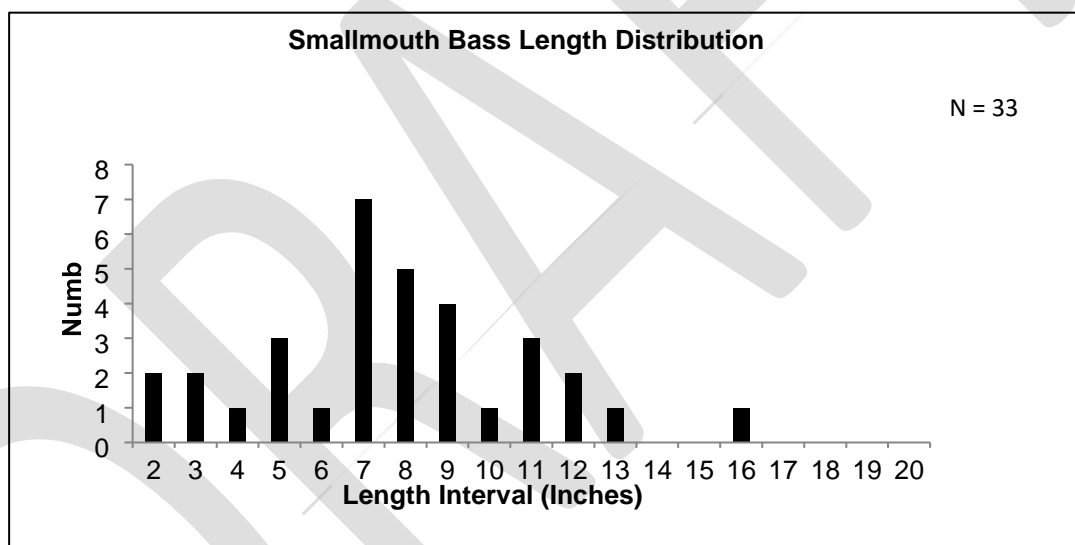


Figure 39 Smallmouth Bass Length Frequency Distribution Taken from Electrofishing in the Wolf River Above Wolf River Pond to Balsam Row Dam, 2014.

Wolf River above Balsam Row Pond to Keshena Falls Results - A total of 255 fish in 10 species, representing 6 families, were collected in the reach of river from Balsam Row Pond upstream to Keshena Falls during an electrofishing survey on April 14, 2016. The primary purpose of this survey was to sample game fish that may have migrated upriver during peak spawning time. Golden Redhorse, Northern Pike, Shorthead Redhorse, and Northern Hog Sucker made up 91.4% of the total catch. Northern Pike (21 total) comprised the majority of game fish captured. Other fish species sampled in low numbers included Muskellunge (1), Walleye (1) and Brown Trout (1).

Table 32 Catch Metrics for Fish Sampled on Wolf River sites

Species	Number Caught (CPUE)		
	Above BRP to Keshena Falls April 2016	Above WRP to Balsam Row Dam May 2014	Above WRP to Balsam Row Dam September 2014
Brown Trout	1 (0.1)	-	
Northern Pike	21 (3.0)	1 (0.6)	3 (3.0)
Muskellunge	1 (0.1)	-	
Common Carp	-	-	1 (1.0)
Blackside Darter	-	-	1 (1.0)
Common Shiner	1 (0.1)	2 (2.2)	-
Hornyhead Chub	-	1 (1.1)	1 (1.0)
White Sucker	10 (1.4)	1 (1.1)	1 (1.0)
Northern Hog Sucker	61 (8.7)	10 (11.1)	23 (23.0)
Silver Redhorse	-	10 (11.1)	22 (22.0)
Golden Redhorse	124 (17.7)	55 (61.1)	28 (28.0)
Shorthead Redhorse	34 (4.9)	18 (20.0)	35 (35.0)
Rock Bass	-	-	5 (5.0)
Pumpkinseed	-	-	1 (1.0)
Bluegill	-	-	1 (1.0)
Smallmouth Bass	1 (0.1)	4 (2.4)	33 (33.0)
Black Crappie	-	1 (1.1)	2 (2.0)
Walleye	1 (0.1)	3 (1.8)	-

In addition, on August 16, 2016, an IBI and game fish survey comprising three different sites was completed in this reach above Balsam Row Pond to Keshena Falls. A total of 122 fish were captured with Smallmouth Bass and Bluegill comprising most of the catch. A total of 36 Smallmouth Bass were captured with catch rates from IBI efforts averaging 15.5 fish per mile. Smallmouth Bass average length was 8.6 inches with a range of 3.2 to 19.7 inches and modes at 3.5, 6.5, and 10 inches (Figure 40). Smallmouth Bass size structure was at moderate levels with an PSD₁₁ and RSD₁₄ at 40% and 25%, respectively.

A total of 17 Northern Pike were sampled with a catch rate of 8.0 Northern Pike per mile. Northern Pike average length was 15.0 inches (range 6.8-19.2 inches) with a mode of 17.5 inches. One Muskellunge was captured and measured 40.1 inches. A total of 53 Bluegill were captured with average length of 4.3 inches and length range of 3.5 to 7.0 inches. A small number of Largemouth Bass (12) and Rock Bass (3) were also captured.

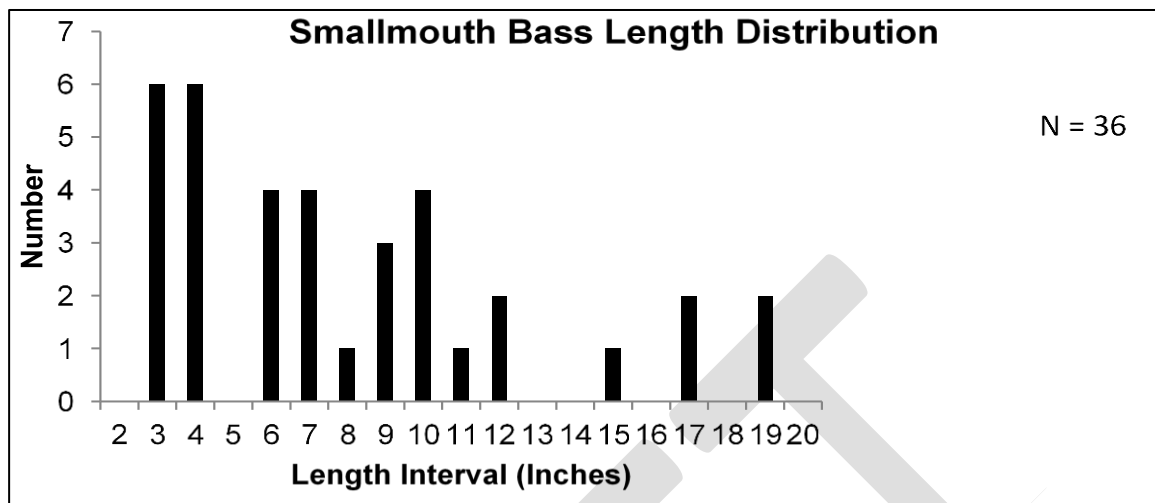


Figure 40 Smallmouth Bass Length Frequency Distribution taken from Electrofishing in the Wolf River above Balsam Row Pond to Keshena Falls, August 2016.

Appendix O: Sturgeon Capture and Transfer

Survey Area: Capture and transfer of Lake Sturgeon occurred from 25 miles below Shawano Paper Mill Dam up to Keshena Falls.

Methods: The capture and transfer of Lake Sturgeon upstream of the Balsam Row and Shawano Paper Mill Dams consisted of using electrofishing to capture adults and sub-adults from the 25 miles of the Wolf River downstream of the Shawano Paper Mill Dam (Figure 41).



Figure 41 WDNR Staff Shocking Lake Sturgeon on the Wolf River

Electrofishing consisted of 2-3 boats generally shocking side by side across the river in a downstream direction to increase the area of the electric field, driving fish from one boat to another, facilitating higher capture rates of fish. Electrofishing boats were operated with pulsed DC (200-230 volts, 8-10 amps, 40 pulses per second, 25% duty cycle) and boat operators followed strict operating procedures to minimize or eliminate the risk of injury to the fish. This included turning off the electric field immediately after the fish was in the net or no longer than 4 seconds after the fish went into narcosis and running limited passes over the same area to reduce the number of times an individual fish may be subjected to the electrical field. Captured Lake Sturgeon were transferred into a 1,450-gallon tank on a fish stocking truck equipped with an aeration system to maintain desired oxygen levels (Figure 43). All transferred fish were measured to the nearest 0.1 inch (TL, measured to the longest point of the caudal fin) and examined for internal and external tags; untagged fish were marked with Monel tags (1995-2003) and/or PIT tags (1999-2016) (Figure 42).



Figure 42 Insertion of Pit Tag Into Lake Sturgeon (left); Surgically Implanting a Sonic Tag Into Lake Sturgeon (right)

1995-2010 Transfers – Annual transfers of Lake Sturgeon occurred from 1995-2002, with an additional transfer in 2006. Transfers occurring between 1995-1999 mostly took place from late-July through August, while fish transferred between 2000-2006 were captured in late October. Fish were not transferred upstream from 2007-2010 due to fish health from VHS restrictions prohibiting transfer of fish upstream. Fish captured and transferred from 1995-2006 were released at various locations including immediately downstream of Keshena Falls (1995-1996), Big Eddy Falls (1997-1998), Dells Falls (1999-2000) and Sullivan Falls (2001-2002). There were 20 fish transferred in October of 2006, but the release location for those fish is unknown. A portion of the fish released each year were marked with radio tags and actively tracked to determine habitat use and monitor rates of downstream dispersal.



Figure 43 Capture and Transfer of Lake Sturgeon on the Wolf River

2011-2016 Transfers - Lake Sturgeon were delisted from the VHS susceptible list following challenge studies conducted on Lake Sturgeon in a lab at Michigan State University (Bruch et al. 2016), allowing transfers to resume in 2011. From 2011 on, a licensed fish health specialist conducted a visual fish health inspection on each captured fish, examining the gills, mouth, eyes, fins, and surfaces (dorsal, ventral, and lateral) for external signs of disease and infection to comply with Wisconsin fish health standards. Fish that failed the health inspection were released back into the lower Wolf River downstream of the Shawano Paper Mill Dam.

Five cohorts of 100+ fish were transferred between fall 2011 and spring 2016 with each cohort consisting of fish transferred during three periods - early fall (late September-early October, late fall (late October-early December, and spring pre-spawn (March-April. The early fall transfer targeted river

resident adults and sub-adults prior to the upstream migration of gravid adults from lentic environments of the Winnebago lake chain in mid-late fall. The objective of targeting early fall fish was to capture predominantly immature fish and/or non-gravid adult fish (Mv-M1; Fv-F3, F6; Bruch et al. 2001). The late fall and spring pre-spawn transfers targeted gravid adults (M2 or F4; Bruch et al. 2001). Spring transferred gravid adults were captured and transferred to release points in the upper Wolf River an average of 12.6 days (range 4 to 21; SD=8.1) prior to the onset of spawning activity at the Shawano Paper Mill Dam on the lower river. The first three transfer cohorts (2011-2012, 2012-2013, and 2013-2014) consisted of the full suite of three transfer periods, while the 2014-2015 and 2015-2016 cohorts consisted only of fish captured during the late fall and spring pre-spawn time periods.

Vemco V-16 transmitters (10-year battery life) were surgically implanted in the abdomens of the majority of the Lake Sturgeon released in the 2011-2012, 2012-2013 and 2013-2014 cohorts to monitor post-release movement, habitat use, and spawning location following release. Acoustic tags (Vemco V-16, 2-year battery life) were also implanted in 48 Lake Sturgeon transferred in late fall (24 released at each location of downstream of Keshena Falls and the Balsam Row Pond) of 2015 to evaluate two potential release locations. Vemco V-16 tags (1-year battery life) were also implanted in 24 fish (12 male and 12 female) transferred above the Shawano Paper Mill Dam in spring 2016 to determine spawning locations and downstream dispersal rates of fish introduced between the two dams (Figure 44).

Sex and maturity stage (Bruch et al. 2001) of each telemetered fish was determined through visual observation of the gonads through an abdominal incision made during the tag implantation process. Sex and reproductive stage was assigned to Lake Sturgeon from the late fall 2014 transfer, in addition to a small percentage of fish in the spring 2016 transfer, using a Sono-Site® M-Turbo® portable ultrasound equipped with a 13-6 MHz transducer, a model similar to that used by Chiotti et al. (2016). The ultrasound interpreter was confident in assignment of sex and reproductive stage of gravid fish (M2 and F4; Bruch et al. 2001), and all non-gravid fish were classified as unknown. Lake Sturgeon transferred in spring 2015 and most fish transferred in spring 2016 were classified as unknown, as sex was not determined with either visual confirmation of the gonad or ultrasound.

An array of 35 Vemco VR2W receivers was deployed to track movements of fish post release. Of the receivers, 29 were previously deployed in Winnebago System waters to monitor movement of acoustic tagged fish downstream of the Shawano Paper Mill Dam. The remaining 6 receivers were deployed solely to evaluate movement of fish transferred upstream of the two dams. Two receivers were deployed within the Menominee Reservation boundary; one receiver deployed above Keshena Falls to evaluate the effectiveness of the natural barrier at Keshena Falls and the other receiver deployed 1.7 miles below Keshena Falls. Two receivers were deployed between the Balsam Row and Shawano Paper Mill dams to monitor movement of fish coming downstream through the Balsam Row Dam. An additional receiver was deployed on the Red River, a tributary that drains into the Wolf River between the Dams and contains suitable spawning habitat, to monitor for potential movement of Lake Sturgeon into the Red River. A receiver was also deployed at the outlet of Shawano Lake to monitor potential movement of Lake Sturgeon into Shawano Lake. Data were downloaded from receivers annually in late

June to ensure post-spawning migrations were completed and fish were utilizing summer home ranges. Water temperatures were tracked and observations made daily each spring to track the optimal time for potential Lake Sturgeon spawning activity at Keshena Falls.

Larval Sampling - Sampling for Lake Sturgeon larvae was conducted in May 2013 using D-frame drift nets (30.0-inch-wide X 21.0-inch high), each with a 11.2-foot-long mesh bag (0.06 inch mesh) and a removable bucket using methods similar to Caroffino et al (2010). Water temperatures following spawning were incorporated into an egg and larval development calculation table developed by Elliott (unpublished data) using data from Aloisi (2006) to predict when larval drift would occur. A total of 8 nets were set <110 yards downstream of where Lake Sturgeon were observed spawning in spring 2013. Nets were fished for a 2-hour period (2100-2300 hours; Kempinger 1988) with nets being emptied each hour and captured larvae preserved in 95% isopropyl alcohol.

Data Analysis

Spawning location was assigned to gravid fish based on location of the fish in relation to documented spawning dates at sites both downstream of Keshena Falls and the Shawano Paper Mill Dam, as well as rate of downstream movement in and around spawning windows (i.e. rapid descent signifying fish was spent). Gravid fish were either classified as spawning upstream of the Balsam Row Dam, between the dams, in the Red River, or in the lower Wolf River downstream of the Shawano Paper Mill Dam. Non-gravid fish were not included in spawning location analyses. Paired t-tests were used to determine whether mean percentages of Lake Sturgeon spawning above the Balsam Row Dam were significantly different between fish transferred in late fall versus spring ($\alpha \leq 0.05$).

Upstream retention of Lake Sturgeon above the Balsam Row Dam and rate of downstream movement through barriers was evaluated by assigning fish location as of the dates of receiver downloads (June of each year 2012-2016). Fish were assigned as being upstream of the Balsam Row Dam, between the dams, or in the Winnebago System (downstream of the Shawano Paper Mill Dam). All Lake Sturgeon with telemetry tags during the first three transfer cohorts were included in retention analyses.

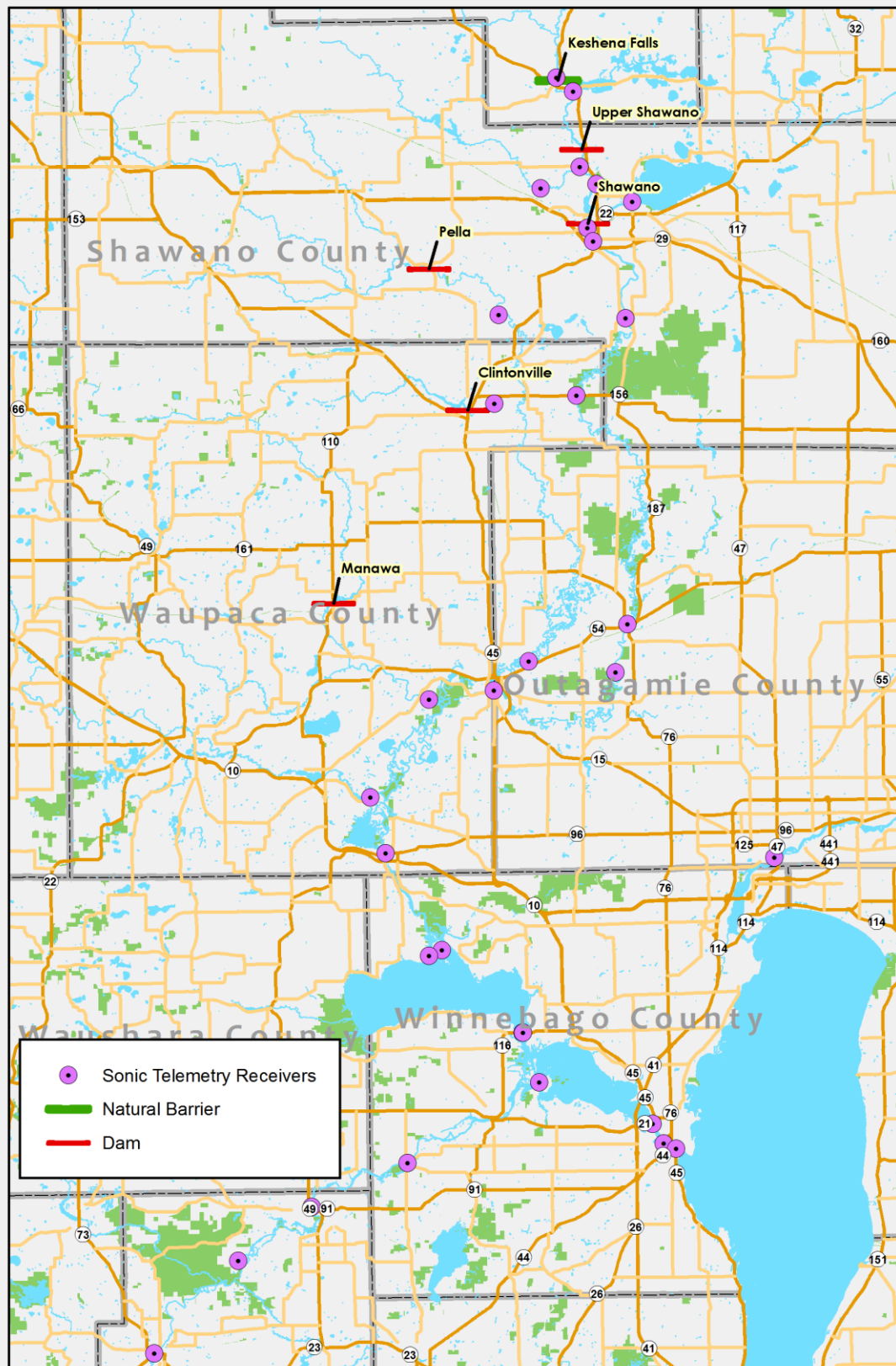


Figure 43 Locations of Telemetry Receivers for Sturgeon

Results

1995-2010 Transfers – A total of 148 Lake Sturgeon were captured from the Lower Wolf River and released upstream of the Balsam Row Dam between 1995-2006. Most of these fish were tracked with radio transmitters. Runstrom et al. (2002) reported that most of the fish transferred below Keshena Falls (96%) migrated downstream through at least the first dam, while fish released at Big Eddy Falls (52%) and the Dalles (12%) were more likely to stay upstream. Lake Sturgeon spawning was observed below Big Eddy Falls in 2001, but egg deposition was not documented (Runstrom et al. 2002).

2011-2016 Transfers - A total of 621 subadult and adult Lake Sturgeon were transferred above the Balsam Row Dam between 2011 and 2016 ranging from 34.0-77.0 inches TL (mean 58.0 inches; SD=9.1). Cohorts ranged in size from 97 to 154 fish (mean 124.2). The lower Wolf River contained abundant fish during the late fall and spring transfer periods, which made it relatively easy to capture target numbers with electrofishing gear. However, fish were far less abundant during the early fall transfer, exemplified by the capture of only 10 fish in 2013. Sex and reproductive stage was determined for all 67 Lake Sturgeon (24 females and 43 males) transferred during the early fall transfers (2011-2013). Most of these fish were non-gravid (83.3% of females and 69.8% of males), thus data from fish transferred in early fall were not included in spawning location analyses. Sex and reproductive stage was determined for 97 of the 126 Lake Sturgeon transferred during the late fall transfers and 81 of the 156 fish transferred during spring transfers spanning 2011-2013. Unlike results from the early fall transfer, most fish from these transfer periods were gravid (Table 33).

Table 33 Percentage of Transferred Gravid Male and Female Lake Sturgeon That Spawned Upstream of Balsam Row Dam

	Late fall		Spring pre-spawn	
Cohort	Female	Male	Female	Male
2011-2012	46.2% (13)	61.1% (18)	66.7% (3)	100% (3)
2012-2013	22.2% (9)	15.0% (20)	66.7% (9)	46.7% (15)
2013-2014	57.1% (7)	47.4% (19)	77.3% (22)	75.0% (12)
Mean	41.8%	41.2%	70.2%	73.9%
SD	17.9%	23.7%	6.1%	26.7%

Table 34 Lake Sturgeon Captures from the Lower Wolf River and Released in the Upper Wolf (1995-2016)

Date	No. Fish	No. Females	No. Males	No. Unk	No. Telemetered	Release Location
08/08/1995	12	3	5	4	-	Keshena Falls
07/31/1996	3	0	0	3	-	Keshena Falls
08/01/1996	3	3	0	0	-	Keshena Falls
08/07/1996	7	1	1	5	-	Keshena Falls
08/12/1997	12	4	1	7	-	Big Eddy Falls
08/12/1998	9	3	3	3	-	Big Eddy Falls
08/17/1999	22	2	0	20	-	Dalles
10/31/2000	19	1	2	16	-	Dalles
10/22/2001	20	0	0	20	-	Sullivan Falls
10/28/2002	21	0	0	21	-	Sullivan Falls
10/30/2006	20	3	4	13	-	Unknown
09/15/2011	30	12	18	0	30	Keshena Falls
10/22/2011	36	14	22	0	36	Keshena Falls
03/21/2012	31	3	3	25	6	Keshena Falls
10/17/2012	27	7	20	0	27	Keshena Falls
11/08/2012	36	10	24	2	34	Keshena Falls
04/15/2013	35	11	24	0	35	Keshena Falls
09/25/2013	10	5	5	0	10	Keshena Falls
10/30/2013	54	8	19	27	27	Keshena Falls
04/14/2014	90	25	15	50	40	Keshena Falls
11/13/2014	42	12	20	10	0	Keshena Falls
04/13/2015	38	0	0	38	0	Keshena Falls
04/14/2015	54	0	0	54	0	Keshena Falls
11/03/2015	24	11	13	0	24	Keshena Falls
11/04/2015	28	11	13	4	24	Balsam Row Pond
04/08/2016	18	0	0	18	0	Keshena Falls
04/14/2016	24	12	12	0	24	Wolf River Pond
04/14/2016	34	3	8	23	0	Keshena Falls
04/15/2016	34	0	0	34	0	Keshena Falls

Lake Sturgeon spawning was visually observed below Keshena Falls each of the 5 springs following transfer of gravid fish. Acoustic telemetry data indicate that the highest percentage of gravid fish spawned in the stretch of the upper Wolf River upstream of the Balsam Row Dam (61.2% of females and 47.0% of males), followed by the lower Wolf River, Red River, and between the dams (Figure 45). No contacts were recorded from 7.5% of gravid females and 5.0% of gravid males. Lake Sturgeon transferred during spring pre-spawn periods were more likely to spawn above the Balsam Row dam than fish transferred in late fall. Spawning percentages for male Lake Sturgeon transferred during the spring transfer periods were significantly higher than from fall transfers ($n=3$, $P<0.01$), while results for females were not significantly different ($n=3$; $P=0.07$) despite higher spawning percentages from spring transferred fish in each year.

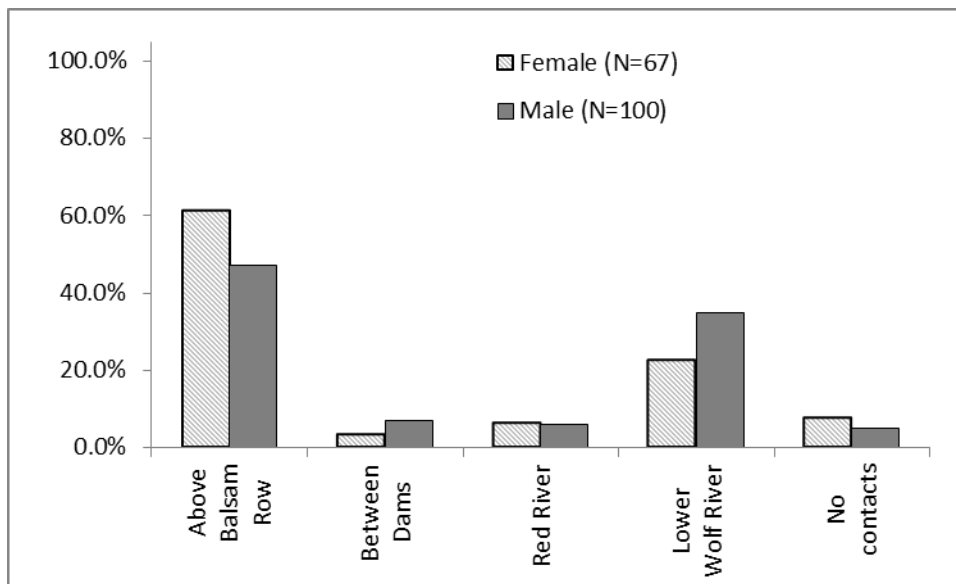


Figure 44 Spawning Locations of Gravid Male and Female Lake Sturgeon Transferred Upstream of Balsam Row Dam (2011-2014). No contacts are fish that were never detected by telemetry receivers.

Regardless of the transfer period, the majority of the transferred Lake Sturgeon moved downstream through the Balsam Row Dam by the time the receivers were downloaded the first June following release. Spring transferred fish appeared to have the highest initial upstream retention rates, however those numbers are inflated by the reduced time that spring transferred fish are in the impoundment prior to the download of receivers in June. Lake Sturgeon transferred in early fall exhibit the greatest retention rates 2 download cycles post-release and beyond but mean upstream retention rates are still below 15%. Mean retention rates of fish transferred in late fall and spring are less than 10% by the second download cycle post-release.

Of the 245 Lake Sturgeon originally marked with acoustic tags, 16 were still classified as being upstream of the Balsam Row Dam at the time of last receiver download in June 2016 (Figure 46) including representative fish from each of the first three transfer cohorts (2011-2012 thru 2013-2014). It is likely that representatives from the 104 non-acoustic tagged Lake Sturgeon transferred in these cohorts also remain above the Balsam Row Dam and that individuals from the 2014-2015 and 2015-2016 cohorts also remain above the Balsam Row Dam. We are unable to know with certainty how many fish still reside above the Balsam Row Dam, but based on retention rates observed from telemetry data, we estimate that approximately 71 sub-adult and adult Lake Sturgeon from the first 5 transfer cohorts were residing upstream of the Balsam Row Dam at the time of the June 2016 download.

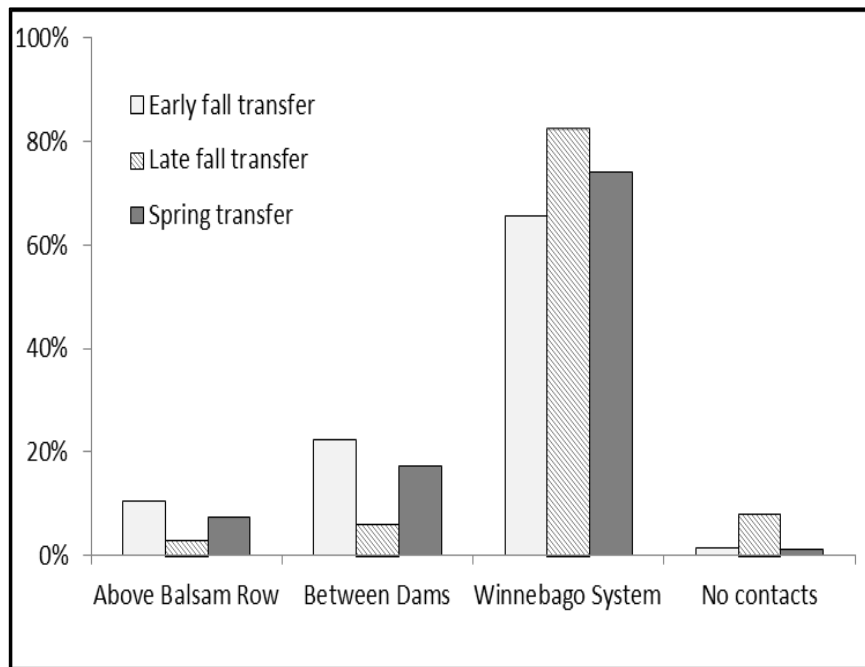


Figure 45 Location of Transferred Lake Sturgeon as of June 2016

Transferred Lake Sturgeon appeared to have a greater affinity to the pool between the Balsam Row and Shawano Paper Mill Dams than above Balsam Row Dam. However, the overwhelming majority (75.1%) of fish transferred in the first three cohorts were downstream through both dams and back into Winnebago System waters by June 2016. There was a relatively small percentage of fish (4.4% of females and 2.8% of males) that were not contacted on any of the receivers during the study period. It is unknown why these fish were not contacted, but equipment failure, tag shedding, and/or mortality could have contributed. No telemetered fish were detected upstream of Keshena Falls or within the Shawano Lake Outlet.

Lake Sturgeon released at the upstream location in fall 2015 were more likely to spawn further upstream in spring 2016. Higher percentages of male Lake Sturgeon released at Chickney Creek (below Keshena Falls) spawned above the Balsam Row Dam, relative to males released into the Balsam Row Pond. Percentages of female Lake Sturgeon spawning above the Balsam Row Dam were comparable for females released at each location, but a higher percentage of females released in the Balsam Row Pond spawned in the Red River and the Lower Wolf River.



Figure 46 Larval Drift Net Sampling at Night

Of the 24 gravid Lake Sturgeon (12 male and 12 female) released in the Wolf River Pond in April 2016, 11 (5 females and 6 males) were between the dams at the time of spawning, 4 (1 female and 3 males) migrated up the Red River, and 8 (6 females and 2 males) were downstream of the Shawano Paper Mill Dam during the spawning window. There was one male that was not detected during the study. As of the early June 2016 download, 3 fish remained above the Shawano Paper Mill Dam, 4 were in the lower Wolf River, and 16 were downstream in either the Upriver Lakes or Lake Winnebago.

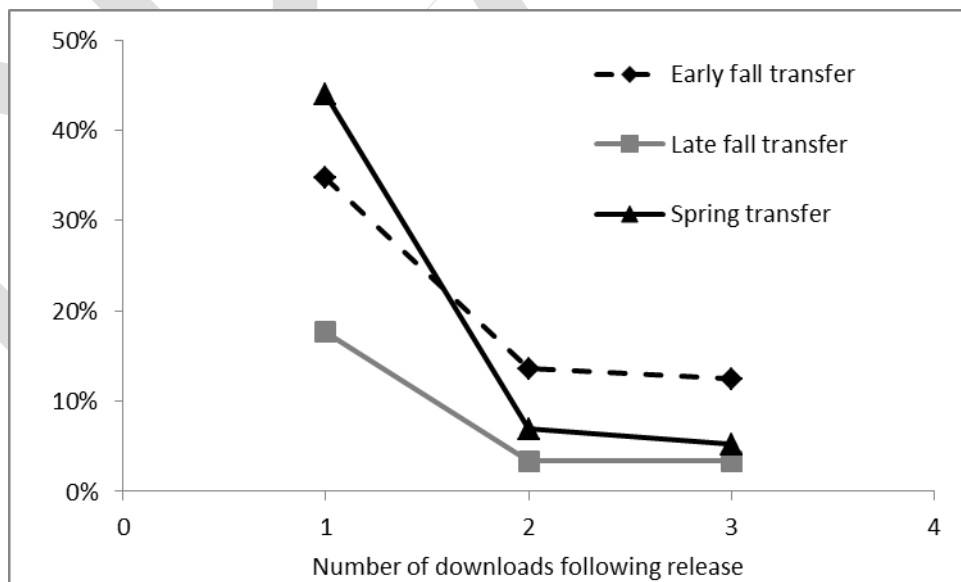


Figure 47 Mean Percentage of Lake Sturgeon Remaining Above the Balsam Row Dam at the Time of Receiver Download in June of Each Year Following Transfer

Larval Sampling - Larval drift net sampling yielded 10 larval Lake Sturgeon over a 2-hour period with larvae captured each hour the nets were sampling (Figure 47). Since the objective was to determine whether larval production was occurring, nets were not reset after the first night's sampling effort.

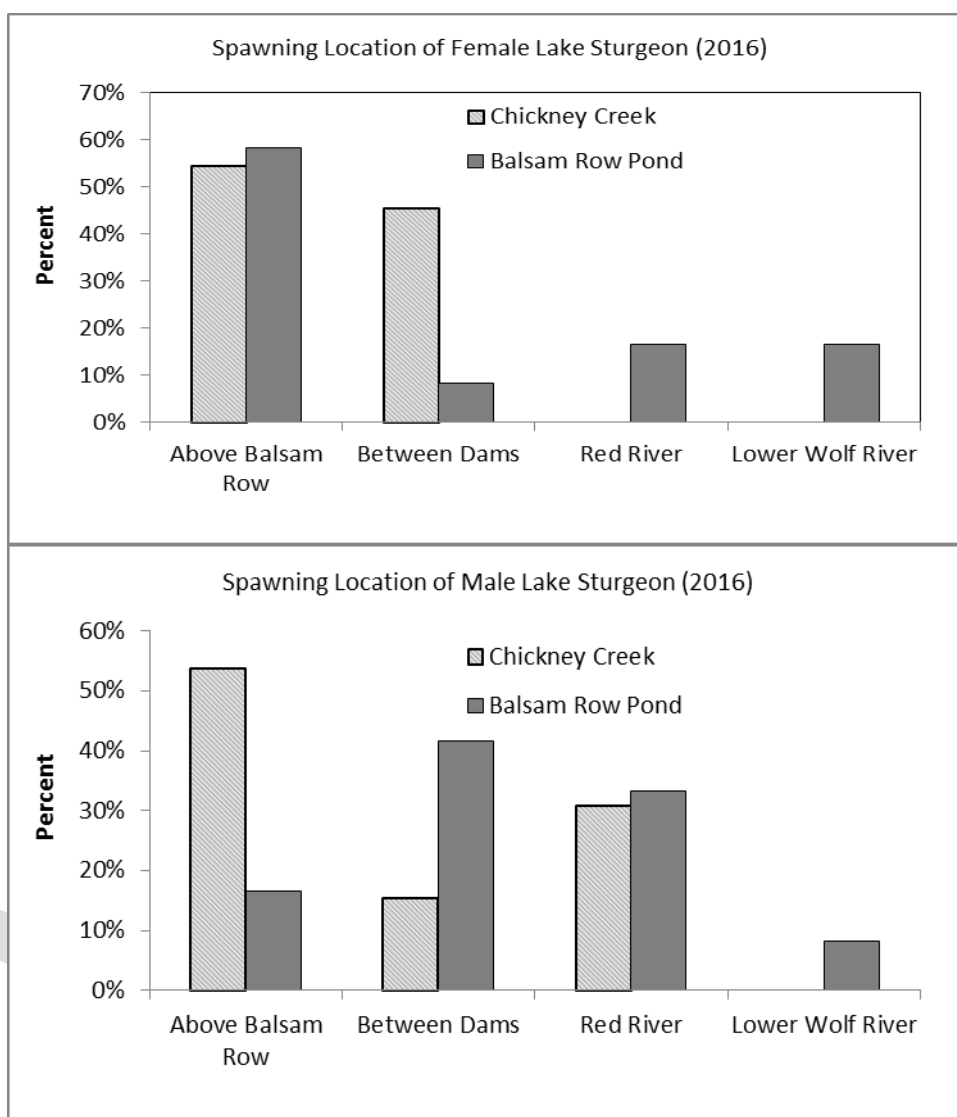


Figure 48. Assigned Spawning Locations of Transferred Gravid Male and Female Lake Sturgeon Released at Chickney Creek and Balsam Row Pond in Fall 2016

Appendix P: Comments and Responses on the Draft Water Resources Management Plan

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